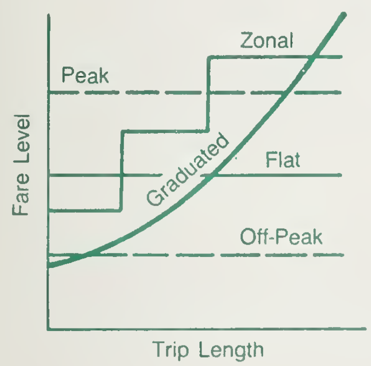
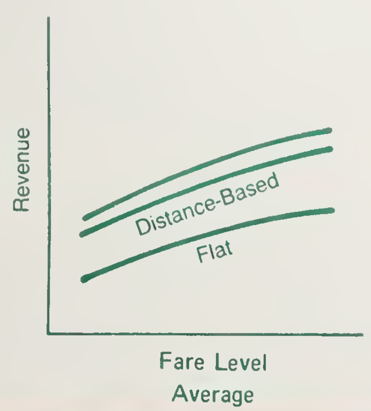
U.S. Department
of Transportation

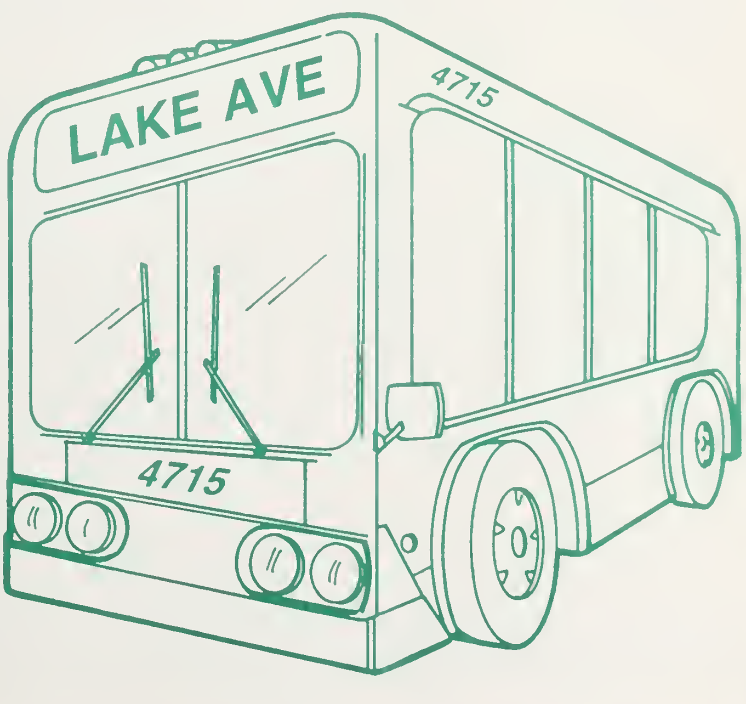
**Urban Mass
Transportation
Administration**

A Manual for Planning and Implementing a Fare Change

Prepared by: Ecosometrics, Incorporated
UMTA-MD-06-0093-85-1







UMTA Technical Assistance Program

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTA-MD-06-0093-85-1		

4. Title and Subtitle	5. Report Date
A Manual For Planning and Implementing a Fare Change	August 24, 1984
	6. Performing Organization Code RR 167-1
7. Author(s) Patrick D. Mayworm, Armando M. Lago, Sue F. Knapp	8. Performing Organization Report No.
9. Performing Organization Name and Address Ecosometrics, Incorporated 4715 Cordell Avenue Bethesda, Maryland 20814	10. Work Unit No. (TRAIS) 11. Contract or Grant No. DTUM60-82-C-72148
12. Sponsoring Agency Name and Address U.S. Department of Transportation Urban Mass Transportation Administration 400 Seventh Street, S.W. Washington, D.C. 20590	13. Type of Report and Period Covered 14. Sponsoring Agency Code

15. Supplementary Notes

Office of Management Research and Transit Services
Service & Methods Division

16. Abstract

Transit fare policy is determined by public bodies on the basis of their understanding of both the transit agency's needs and the general population's needs and preferences. This manual is designed to assist senior transit managers and transit board members in planning and implementing fare changes. The manual outlines the process that should be undertaken to ensure that the most efficient and equitable fare plans are submitted to policy-makers for approval. It is then up to the board members to use their political discretion in adopting a plan.

This manual is divided into seven chapters reflecting the sequence of events that generally transpire when planning a fare change including; a description of the data that should be assembled and how they can be managed; a review of the fare options that are available to most transit agencies; a description of how to select the appropriate fare plan to meet the specific objectives of the transit agency; and a description of the steps that should be followed in implementing and evaluating a fare change. It is important to understand that this manual describes a process of fare evaluation and selection and not simply the mechanics of deciding how high the fare should be raised. The authors hope that these guidelines will provide managers and policy-makers with the background and tools to assist them in designing fare changes that are efficient and equitable.

17. Key Words	18. Distribution Statement
transit fares, elasticities, pricing policy, fare collection, distance-based fares, zone fares, time of day fares, fare increases.	Available to the public through the National Technical Information Service Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

ECOSOMETRICS INCORPORATED

Research Report 167-1

A MANUAL FOR PLANNING AND IMPLEMENTING A FARE CHANGE

by

Patrick D. Mayworm
Armando M. Lago
Sue F. Knapp

August 24, 1984

for

Service and Methods Division
Office of Management Research and Transit Services
Urban Mass Transportation Administration
U.S. Department of Transportation

Contract DTUM60-82-C-72148

4715 CORDELL AVENUE • BETHESDA, MARYLAND 20814 301/652-2414

PREFACE

Transit fare policy is determined by public bodies on the basis of their understanding of both the transit agency's needs and the general population's needs and preferences. Since one location will have different needs and aspirations than another, transit fare policies are seldom the same. Moreover, fare policies will change from time to time even within the same area as public attitudes and priorities change. In light of these conditions, the establishment of fare policy must be based on economic and technical issues, as well as political issues, since the main purpose of fare policy in these times of budgetary restraint is to generate passenger revenues in the most efficient and equitable manner.

This manual is designed to assist senior transit managers and transit board members in planning and implementing fare changes. The manual outlines the process that should be undertaken to ensure that the most efficient and equitable fare plans are submitted to policy-makers for approval. It is then up to the board members to use their political discretion in adopting a plan.

This manual is divided into seven chapters, reflecting the sequence of events that generally transpire when planning a fare change. Chapter 1 describes the role of fare policy in financing public transportation services. Chapters 2 and 3 describe the fare planning process and the basic organizational requirements for carrying the process from conception to implementation. The fourth chapter describes the data that should be assembled and how they can be managed. Chapter 5 provides a review of the fare options that are available to most transit agencies. In particular, the chapter reviews alternative fare structures, fare collection methods, and promotional fare policies. With this background, the sixth chapter describes how to select the appropriate fare plan to meet the specific objectives of the transit agency. Finally, Chapter 7 describes the steps that should be followed in implementing and evaluating a fare change.

It is important to understand that this manual describes a process of fare evaluation and selection and not simply the mechanics of deciding how high the fare should be raised. The authors hope that these guidelines will provide managers and policy-makers with the background and tools to assist them in designing fare changes that are efficient and equitable.

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THE ROLE OF FARE POLICY

1

THE ROLE OF FARE POLICY IN PUBLIC TRANSIT FINANCING

Passenger fares were the predominant, if not the only, source of funds for most public transportation systems until the 1960s. As it became more difficult to finance public transportation solely from the farebox, municipalities and other public authorities assumed the ownership and responsibility for what had previously been privately owned companies. The Federal government began to provide greater assistance to meet the deficits created by increasing costs and declining revenues.

Problems revolving around fares as the major source of income included:

- a major decline in transit ridership since the period of greatest usage during World War II,
- a reluctance to raise fares by those responsible for regulating the operations of the then privately owned companies,
- the perception of public transit as an "inferior good" that needed to be priced substantially below other modes to attract riders, and
- the recognition that a substantial portion of transit riders was a "captive market" that could afford no other option (meaning that any fare increases would constitute a special economic hardship).

A number of these problems were explicitly recognized in the UMTA legislation of 1974 that, for the first time, provided Federal funds to subsidize operating losses incurred by transit authorities in urban areas. This assistance was explicitly provided so localities could maintain the lowest possible fares and thus attract more riders.

These issues have now changed. Until recently, transit ridership had been increasing. Further, the new equipment and services operated by many properties have dispelled much of the negative image associated with transit riding. But a large captive or transit-dependent submarket still exists, and this is one of the considerations that continues to make fare increases politically sensitive and difficult.

How high should the fare be raised? How much revenue should the user pay? And how much of the operating expenses should be paid through subsidies? These are the principal questions that must be resolved each time a fare change is contemplated. They reflect the basic issue of identifying the appropriate role of fare policy in financing public transit services.

Although some people advocate free fares for public transit, most political leaders and managers agree that the user should pay some proportion of transit operating costs. This is true for two reasons:

- to raise operating revenues, and
- to allocate transit services.

The revenue function of a fare policy is to recover funds from users to meet the expenses of providing transit services. Fares, along with the ridership at that fare level, provide information on how transit users value the different service levels offered. The allocation function of a fare policy is to distribute the demand for transit services to the level of supply. Most transit systems will have numerous types of routes and services, with riders responding differently to each. Service decisions regarding the allocation of bus miles (supply) to those routes and services cannot be accomplished without considering the route's net revenue position and the revenue impact of small incremental changes in bus miles (supply) at the route or service level.

HOW MUCH SHOULD USERS PAY?

Once it has been established that users should help pay for the services they consume, the next issue is to determine how much they should contribute. Clearly, this is a political decision that each transit board will have to determine based on how transit service is perceived in the community. Economists argue that users should pay a price equal to the marginal cost (that is, the

additional cost of transporting one more rider). While this is the most efficient price, it may also be too high to be politically feasible. Moreover, many political leaders feel that the community as a whole benefits from the existence of transit service, and thus, some government subsidization is justifiable. Reduced traffic congestion, improved air quality, and to a lesser extent, increased economic activity in the central business districts (CBDs) of our cities have all been identified as benefits of transit service. The arguments in support of these claims are rather complex and the evidence on which to test them is not always strong. Consequently, it is difficult to establish a standard level for all communities at which operating subsidies should be provided.

Traditionally, fares have been kept low to benefit low-income users. Research has shown, however, that most transit subsidies financed by state and local taxes are relatively inefficient mechanisms for channeling assistance to low-income or other disadvantaged groups because of the inability to target the subsidy. The benefits of low fares go to riders of all income classes, high and middle, as well as low. Another approach to subsidizing low-income users might be to maintain an established farebox recovery rate and to target specific users by such means as transportation vouchers or coupons valid for transit services.

How much users should pay and how much should come from government subsidies should be determined based on an understanding of all these issues. But clearly, if Federal operating assistance is curtailed without the infusion of new operating subsidies, farebox revenues will have to represent a larger share of operating expenses than they do today.

BALANCING FARE AND SERVICE LEVELS

There is a tendency to think of the fare level only in terms of what it will do to the financial condition of the transit agency. Seldom, if ever, do transit managers plan fare changes in conjunction with service changes to meet ridership needs. For example, there is a basic question of whether financial resources, generated either internally or externally, should be used to support fares or services. Money spent holding fares down might produce more ridership and revenues if it were spent maintaining or increasing services.

To illustrate this point, consider the relationship that exists among farebox revenues, outside subsidy support, and the cost of transit services. As shown below, costs must be equal to subsidy plus revenue:

$$\boxed{\text{COST} = \text{SUBSIDY} + \text{REVENUE}}$$

If, for example, subsidy support diminishes, one or both of the remaining components in the equation must be adjusted to maintain the balance between cost (outputs) and subsidy plus revenue (inputs). Typically, in the wake of subsidy shortfalls, fares are increased and service levels are reduced so that available revenues cover the operating expenses remaining after all outside subsidies have been committed. But are such decisions always the best answers, or are they only temporary solutions? Fares can play a more important role in supporting new services.

The principal problem with transit planning today is that fare and service-level decisions are seldom jointly planned, even though fares and service levels are intrinsically related. In addition, less traditional fare and service concepts are seldom given serious consideration when major policy changes are under review. Some of these interesting concepts include conversion from conventional service to paratransit (vanpools and taxi feeders), conversion of some services to quality-based services with truly premium fares, and developing private sector assistance and support (through merchant validation, business support of specific services, and employer-subsidized pass programs).

This manual takes the position that fares do play an important role in transit financing. They indicate the value of transit service since riders are clearly willing to pay different prices for different levels of service. More important, however, transit service benefits most those who use the service. A user fee, therefore, is appropriate.

2

PLANNING FOR A FARE CHANGE

2

PLANNING FOR A FARE CHANGE: THE BASIC IDEA

Transit managers and policy-makers have long advocated establishing fare levels that would not change over several years. However, with rising costs and uncertainties about the level of operating subsidies available, fare changes have been occurring more frequently. Fare changes should, in fact, be considered at least annually since the demand for transit service is constantly changing. Moreover, new fare policies must be set as new service concepts are developed and implemented.

Planning a fare change, therefore, is not an occasional event, but rather a process that may involve all personnel levels within the organization and may also affect the services provided, the level of patronage, and the financial position of the agency. This manual presents a structured fare planning process that involves developing a detailed strategy for meeting your agency's goal for providing service. As an example, the fare planning process can yield a fare plan that, when implemented, maximizes ridership while meeting the revenue requirements not met by other sources.

THE BASIC IDEA

The fare planning process involves a series of five tasks, as shown in Figure 2-1. The method outlined here follows the basic format of a management by objectives (MBO) approach to planning. The tasks are implemented in an orderly

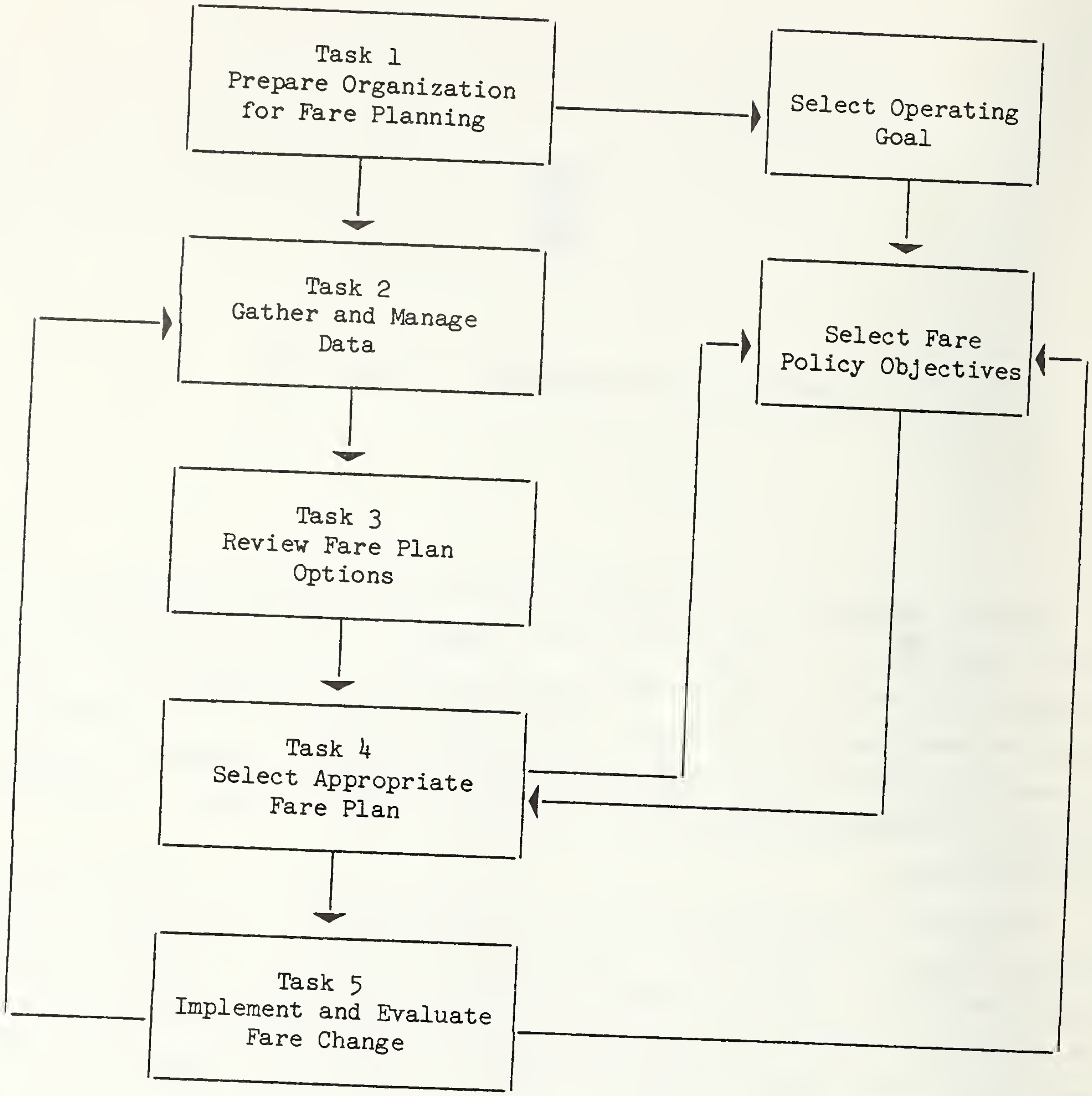

Figure 2-1: THE FARE PLANNING PROCESS

sequence, beginning with the identification of roles and responsibilities for different members of the organization, through the establishment of fare policy objectives, and finally the analysis that will yield a fare plan for implementation.

Task 1: Preparing Your Organization for Fare Planning

Before the staff begins pondering the options that might be included in a new fare plan, management must clearly identify the roles and responsibilities of each division of the agency, its staff members, and the transit board. Management should make every attempt to include in the planning process everyone who will be affected by fare planning decisions. In that way, management will be able to guarantee that the new fare plan will be implemented with minimal problems.

The operating goal of the transit agency should be clearly identified by management and the transit board. In most cases, this crucial starting point in the planning process has already been accomplished. The purpose of the mission statement is to clarify why the transit agency exists and where it is heading.

Finally, management and the transit board must work together to establish a set of fare policy objectives that the transit agency wants to meet in the near future. The objectives are statements of results that, taken together, move the agency toward the stated goal. For every objective, however, there will also be a set of constraints that must be similarly identified.

Task 2: Gathering and Managing Data

A good fare plan is based on good information. The basic information that must be collected to develop a sound fare plan includes data on operating costs, ridership, and revenues. In addition, most transit agencies should be able to collect such information at the route level, disaggregated by time of day, and for systems with long trip lengths, by zone or district. Other information on the cost of collecting fares will also be useful in the fare planning process.

If data are going to be meaningful to management and the policy board, they must be organized and presented well. It is always helpful to complement numbers

on costs, ridership, and revenues with graphics. Bar and line charts showing trends are useful management tools because they communicate information quickly and efficiently.

The information employed to analyze alternative fare options may not always be readily available. Demand elasticities, for example, are needed to test the ridership and revenue impacts of fare changes. Although demand elasticities from other systems can be used, it is advised that elasticities be estimated from historical data collected from your own transit agency. Thus, the management of information may also require data analysis.

Task 3: Reviewing Fare Options

To develop a fare plan appropriate for your transit system, you should be aware of the advantages and disadvantages of alternative fare structures, fare collection methods, and policies on the use of promotional fares.

The fare structure refers to the relative prices charged for different transit services. In a flat fare structure, all riders are charged the same fare for all services during all periods of the day. A flat fare structure, consequently, is the easiest system to apply. Alternative fare structures include distance-based, time-based, and quality-based fares, special fares for different user groups, and transfer charges. Each fare structure can be applied uniquely or in conjunction with another fare structure.

It is important to consider how the fare is collected when a change in fares is contemplated. As fare levels approach and exceed one dollar, cash payment -- the dominant method of fare payment -- becomes more burdensome on both the operator and the user. Alternative fare collection methods that can be analyzed for their ridership, cost, and operational impacts include fare prepayment, fare postpayment, and self-service fare collection. The latter method of payment has only recently been applied in this country.

Finally, every transit system will at one time or another experiment with promotional fares as a marketing tool to generate ridership. The experience of using price to generate rides without having a negative impact on revenues is mixed. Fortunately, a significant amount of research has been done on price promotion, to help managers select the method that will best reach their target populations.

Task 4: Selecting the Appropriate Fare Plan

The most important task in the fare planning process is selecting the fare plan that will be submitted to the transit board for approval. This phase, which requires the greatest amount of technical work involving many staff levels, constitutes five separate steps.

First, the staff should provide a detailed inventory of the existing conditions in the transit system. The existing fare levels and policies, ridership and revenue levels by fare paying category, operating cost information, and issues related to the fare collection process should be clearly identified.

Second, board members, management, and staff must decide what evaluation criteria to select, and how they will be used to evaluate the alternative fare structures, fare collection methods, promotional fares, and fare levels under review. The evaluation criteria should include at least the following concepts: revenue production, ridership generation, operational simplicity and cost, and user equity.

The third step involves selecting the fare options to test. Numerous options could be tested because of the many combinations of fare structures and fare collection methods available. Consequently, management and staff must be able to combine their knowledge of the current system with the range of options available, to develop a short list of three or four options that can be evaluated in more detail.

The actual evaluation process takes place in the fourth step. Here, a technical analysis of each option is performed, as well as a subjective review by operations and planning staff to determine the workability of each option. The result of this analysis will be a ranking of each option according to how well it meets specific criteria established earlier in the process.

The final step is recommending a fare plan to the transit board for approval. Here, the staff presents the options to the board, describing why the recommended plan is the preferred choice. If the board members are aware of the selection process described in this manual and have participated in defining the objectives and evaluation criteria, the approval process should flow smoothly. It is imperative that the board members contribute to the fare planning process before a fare plan is presented to them for approval.

Task 5: Implementing and Evaluating the Fare Change

Now that a fare plan has been adopted by the transit board, management and staff must come up with a schedule for its implementation. This requires the concerted effort of the planning, marketing, and operations departments of the transit agency. While some fare changes can be made at one time, most complex fare changes require implementation in sequence to minimize confusion and cost. The marketing department is usually given the role of selling the new fare plan to the public.

Because of funding shortages, many transit agencies do not monitor and evaluate the impacts of fare changes. Since fare planning is a process that should recur at least annually, data on the effect of fare changes on ridership, costs, and revenues are important for future fare planning. If an efficient system for collecting data is in place, evaluating the impacts of fare changes can be an inexpensive endeavor.

3

PREPARING YOUR ORGANIZATION

Task 1		Task 2		Task 3		Task 4		Task 5
Prepare Organization for Fare Planning	→	Gather and Manage Data	→	Review Fare Plan Options	→	Select Appropriate Fare Plan	→	Implement and Evaluate Fare Change

3

PREPARING YOUR ORGANIZATION FOR FARE PLANNING
(TASK 1)

If fare planning is to be an efficient process with a minimum of delays and problems, management must be prepared to clearly identify the roles and responsibilities of individuals within the organization. In addition, it must be able to work with the transit board to establish an overall fare policy for the agency and a set of fare policy objectives. Only with these in place can the transit agency begin to develop a fare plan.

DEFINING AN ORGANIZATIONAL STRUCTURE AND STAFF RESPONSIBILITY

The purpose of defining an organizational structure at the outset is to identify who in the organization should be involved in fare planning and what their roles should be. Several levels of personnel are involved in fare planning. At the top, senior management and transit board members set the policies and establish the goals and objectives of the organization. They are responsible for the fare plan that finally emerges from the process outlined in this manual. Staff members, on the other hand, are responsible for data collection and management, data analysis, and other technical issues in fare planning. In many organizations, the staff provides the planning process with knowledge of the state-of-the-art in fare practices and of day-to-day operational issues. Table 3-1 shows which groups have the responsibility for accomplishing each task in the fare planning process.

Table 3-1

RESPONSIBILITIES BY PLANNING TASK

Planning Task	LEVEL OF RESPONSIBILITY		
	Transit Board	Senior Management	Transit Staff
Task 1: Preparing Your Organization For Fare Planning	Minor	Major	None
Task 2: Gathering and Managing Data	None	Minor	Major
Task 3: Reviewing Fare Options	Minor	Major	Major
Task 4: Selecting the Appropriate Fare Plan	Major	Major	Major
Task 5: Implementing and Evaluating the Fare Change	None	Minor	Major

In addition to establishing levels of responsibility, management must also identify which divisions within the organization should participate in the fare planning process. This is often a difficult task since too many actors could inadvertently slow down the process without substantially contributing to it. On the other hand, management must be sure to include those groups that would be affected by any change in fare policy. By not doing so, management runs the risk of delaying implementation or worse, creating problems during implementation that would require a major effort to correct. By involving all agency divisions that are affected by fare changes and by clearly establishing their roles and responsibilities, management will guarantee a smooth implementation process. Table 3-2 identifies the divisions within a typical transit agency that should be involved in most fare planning decisions.

Table 3-2

OVERVIEW OF ROLE OF TRANSIT AGENCY DIVISIONS IN FARE CHANGES

Transit Agency Division	Task
Administrative	• Manage fare analysis process. • Work with board to set policies. • Work with board to select appropriate structures and level.
Planning	• Manage data. • Develop fare options. • Develop evaluation criteria materials. • Prepare evaluation measures.
Marketing	• Gather data. • Plan fare collection procedures. • Plan and develop community information. • Coordinate community review process and public hearings.
Maintenance	• None.
Operations	• Train drivers in new fare collection procedures. • Collect fares.

SETTING OVERALL FARE POLICY

Fare planning is only one of many activities that a transit agency performs. The overall fare policies that direct this planning effort must be established by senior management and policy-makers following the operating goals of the transit agency. A goal is a hoped-for state reflecting the agency's purpose in providing service.

The fare policies set by management and the transit board are generalized statements of the agency's values concerning how fares should be set while meeting the financial and operational needs of the organization. The fare policy objectives described below are statements of specific purpose that direct the agency toward achieving the stated fare policy. While objectives are quantifiable and usually met during the planning cycle, overall fare policies are abstract and serve as a link between technical planning and the goals of the transit agency.

Transit fare policies can usually be categorized into one of four groups:

- revenue production,
- ridership generation,
- operational needs and costs, and
- user equity.

Revenue production policies are those that identify the importance of farebox revenues. If subsidy sources are plentiful, revenue production policies may not be as important as ridership or equity policies. However, as transit operating costs rise without a similar increase in operating subsidies, most transit agencies will be setting fare policies whose main objective will be revenue generation from changes in fare levels and fare structures.

Ridership generation policies have usually become less important as farebox revenues have become a major source of funds for financing transit service. Very often transit boards will set policies that determine a minimum loss of ridership that can result from a fare change.

Policies are usually also established to promote fare structure simplicity, operational feasibility, and cost-effectiveness. Simplicity and understandability have become increasingly important as fare structure designs have become more complex. These fare policies are designed to maintain passenger commitment and low cost.

Fare policies promoting user equity are often vague simply because few policy-makers have defined the term "equity." Recent definitions used in formulating policy objectives include equivalent fare per mile and equivalent cost recovery. Table 3-3 presents a sample of a typical system's fare policy.

Table 3-3

SAMPLE: USA TRANSIT FARE POLICY

1. Revenues should increase.
2. The fare level and structure should encourage ridership.
3. The fare structure should be equitable.
4. The fares should be simple to understand.
5. Fare collection should be easy to enforce and involve minimal costs.
6. The fare structure should help achieve other socioeconomic goals.

SETTING FARE POLICY OBJECTIVES

Once board members have decided on the fare policies for the transit agency, management must plot a strategy for meeting them. Specific fare policy objectives are established for this purpose. The objectives are used in the planning process to clearly define the position of the transit agency once the fare plan has become operational. The fare planning process, therefore, is designed to meet those objectives.

In selecting the objectives, management must be certain that it develops a comprehensive list covering all aspects of a given fare policy. The policy objectives, moreover, should be measurable whenever possible. "Increasing farebox revenues" is not a measurable quantity. "Increasing farebox revenues by $1 million per year" is a specific objective that can be used to evaluate alternative fare plans.

Occasionally, however, fare policy objectives cannot be measured or forecasted in precise quantitative units. Professional judgmental ratings or rankings should then be used. Such measures are often as important as the quantifiable objectives in an evaluation. As described in Chapter 6, the evaluation and selection process involves both the qualitative and the quantitative impacts.

Fare policy objectives, like the policies they hope to achieve, are not static. They are subject to continuous review and can be modified as conditions change. What is important to remember, however, is that they provide a means of initiating a fare planning process. Without clearly stated objectives that can be realistically reached during the planning cycle, the fare planning process would be without the direction and yardsticks needed to evaluate fare plans. Table 3-4 presents a sample of fare objectives for a typical system.

Table 3-4

SAMPLE: USA TRANSIT FARE OBJECTIVES

Goal	Objective
Revenues should be increased.	• Revenues should be at a level such that revenue plus subsidy cover all operating costs.
The fare level and structure should encourage ridership.	• Maximize ridership.
The fare structure should be equitable.	• Passengers traveling at same time of day for the same distance should pay the same amounts. • The cost per passenger mile should be comparable for all users regardless of trip distance.
The fares should be simple to understand.	• Fares should be easy to pay. • Fares should be easy to explain to users.
Fare collection should be easy to enforce and involve minimal costs.	• Opportunity for fraud or fare should be minimized. • Collection and administrative costs should be minimized. • Fare collection equipment. • Equipment maintenance costs should be minimized.
The fare structure should help achieve other socioeconomic goals.	• The fare structure or level should not inhibit ridership of individuals to the point of creating economic hardship. • The fare structure or level should not inhibit ridership to the point where it is detrimental to the environment of the community (by increasing traffic congestion, air pollution, or energy consumption).

4

GATHERING AND MANAGING DATA

Task 1		Task 2		Task 3		Task 4		Task 5
Task 1 Prepare Organization for Fare Planning	→	**Task 2 Gather and Manage Data**	→	Task 3 Review Fare Plan Options	→	Task 4 Select Appropriate Fare Plan	→	Task 5 Implement and Evaluate Fare Change

4

GATHERING AND MANAGING FARE PLANNING DATA (TASK 2)

Fare planning is only as good as the information on which it is based. Consequently, management must be certain that accurate, timely, and relevant data are collected and managed to support the fare planning activities outlined in this manual.

Fare planning is not independent from service or financial planning. Ridership, for example, is affected by travel time, service reliability, walk time, and comfort, as well as by price. The amount of service miles provided, in fact, will be determined indirectly from the level of fares charged. The data collected and managed to support fare planning, therefore, are used for several levels of decision-making.

This chapter describes the information necessary for fare planning and how it should be managed. In addition, some data used in the evaluation must be derived or estimated from available information. Demand elasticities, for example, should be estimated from historical data on past ridership response to fare changes. The most popular methods for doing this are briefly described below.

GATHERING FARE PLANNING DATA

For most fare planning activities, transit managers need to collect only four types of data:

- ridership,
- revenues,
- vehicle miles, and
- operating costs.

If relatively accurate and timely statistics can be easily obtained, most of the fare plan options described in this manual can be evaluated with these data.

Since the fare planning process is interested in adapting the fare structure to on-going changes, each of the data types mentioned above must be viewed over time. Statistics on each of the variables should be collected periodically (in other words, time-series data are required). Very frequent tabulations made by the day or week are perhaps useful for day-to-day operations, but are not necessary for fare planning. Data tabulated on a monthly basis are most appropriate.

In addition to time-series data, each data type should be disaggregated on at least three dimensions: route type, time of day, and payment method. The geographic dimension will allow management to analyze fare options by route type and by trip length. Although providing revenue, ridership, vehicle miles, and operating costs by route type is not particularly difficult, most transit agencies will have problems disaggregating revenues and ridership by trip length. Occasional surveys of passengers is the only way to maintain timely information on trip-length distributions.

It is also important to collect data along the temporal dimension since fare structures can be designed to consider differences in travel demand and marginal costs. Data should be disaggregated into a.m. and p.m. peaks, midday, evening, and late night. Data on weekend service should also be provided.

Finally, revenue and ridership statistics should be disaggregated according to payment method and fare paying group. Cash fares, for example, should be divided according to the type of cash fares available (adult, student, senior citizen, etc.). Fare prepayment methods should be similarly disaggregated.

Table 4-1 presents an example of the distribution of weekday ridership by fare category, time of day, and trip distance. Figure 4-1 presents a schematic of the data types to be collected for fare planning, along with the various characteristics upon which those data should be disaggregated.

Table 4-1: DISTRIBUTION OF WEEKDAY RIDERSHIP BY FARE PAYING CATEGORY, TIME OF DAY, AND TRIP DISTANCE

Fare Paying Category	A.M. & P.M. PEAK HOURS					OFF-PEAK HOURS					TOTAL
	City of Pricing		Suburbs		SUB-TOTAL	City of Pricing		Suburbs		SUB-TOTAL	
	CBD (1 Mile)	Zone 2 (2.5 Miles)	Zone 3 (5.5 Miles)	Zone 4 (10 Miles)		CBD	Zone 2	Zone 3	Zone 4		
Cash Fare	7,130	6,415	1,430	1,425	16,400	3,570	2,855	1,000	430	7,855	24,255
10-Trip Ticket Book	1,140	750	570	390	2,850	855	425	280	150	1,710	4,560
Monthly Pass	3,440	1,720	860	430	6,450	920	580	350	315	2,165	8,615
Express Service	0	0	1,135	760	1,895	0	0	0	0	0	1,895
Elderly & Handicapped	1,068	715	535	352	2,670	3,200	2,135	1,600	1,070	8,005	10,675
TOTAL	12,778	9,600	4,530	3,357	30,265	8,545	5,995	3,230	1,965	19,735	50,000

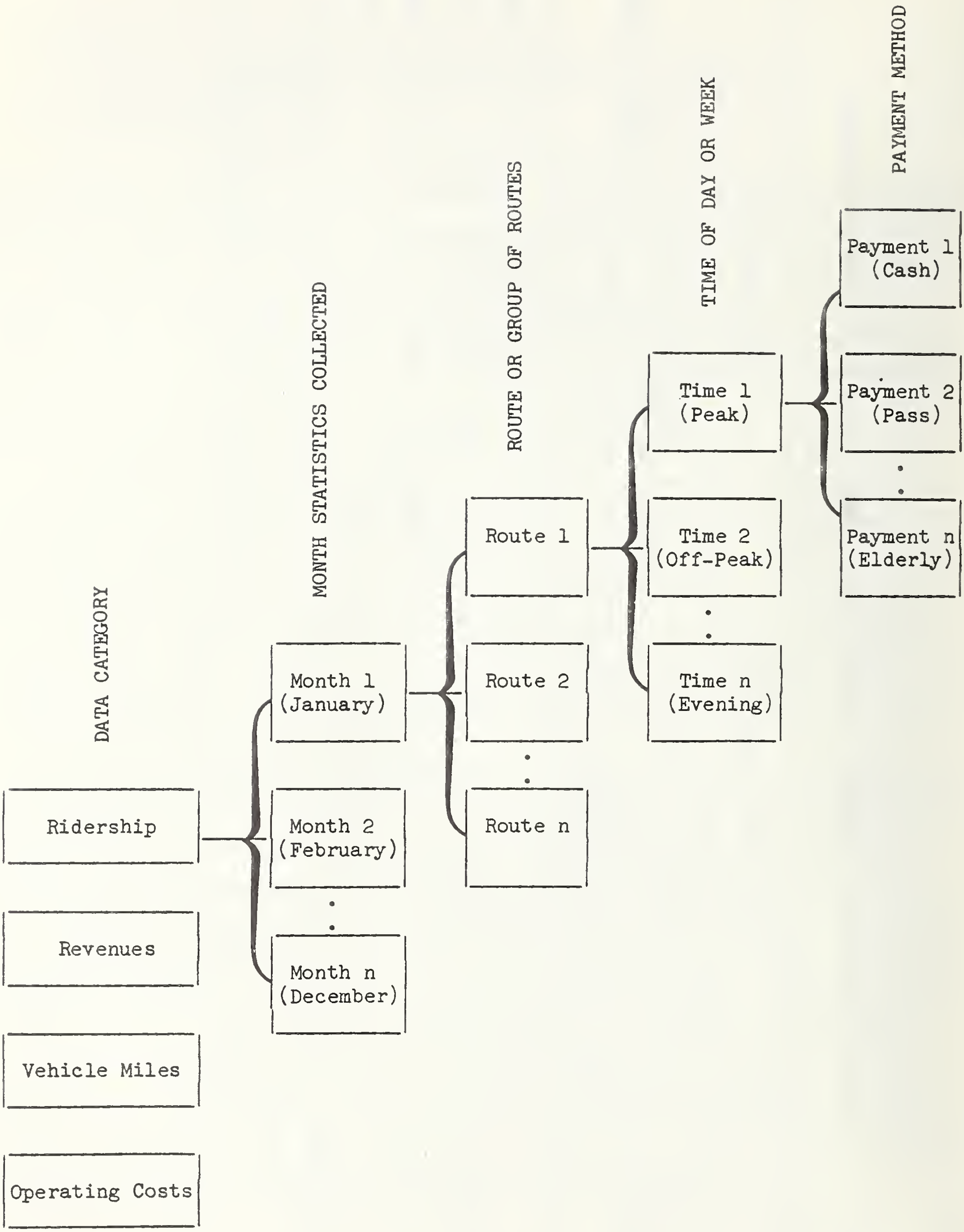

Figure 4-1: DISAGGREGATION OF FARE PLANNING DATA

MANAGING FARE PLANNING DATA

The purpose of collecting data is to assist managers in making decisions. Pages of computer printouts, therefore, must be organized and presented to management in such a way as to facilitate the decision-making process. Information is processed data.

The first point about processing data is that all figures should be presented in chronological order. Since most of the data are collected periodically, management should be viewing the figures as the events took place. It is also advisable that entire reporting periods should be displayed at the same time.

Frequently, data can be more meaningful if they are combined with other data in the form of ratios or sums. The revenue-to-cost ratio, for example, is an extremely important and useful piece of information. Other indicators include passengers per vehicle mile and operating cost per employee.

The performance of a route is usually analyzed by comparing indicators over time. Comparisons are extremely important since they indicate when ridership, revenues, or other factors change. For time-series data, management should always compare current data with what occurred during the same month a year ago. Monthly fluctuations occur naturally and comparisons with recent months can cloud the actual trend that is occurring. One way to correct for the fluctuations is to apply any number of smoothing techniques.

Management and staff may also use data to test the accuracy of previous projections. Comparing what actually occurred with what was projected will indicate major differences. Trying to understand why the forecasted values were off is important in improving the forecasting techniques used by the agency.

Finally, fare planning data can be presented graphically. The monthly ridership levels on different routes over the past 12 months can be clearly portrayed with line charts. Bar charts provide a similar resource for plotting one or two items over time. Very often, management will find that a graphic presentation of data will communicate information in much less time than tabulations of data. This resource is clearly applicable in fare planning.

ANALYZING FARE PLANNING DATA

Some data that must be used in the fare planning process are not readily available. The two most important categories of required data are elasticities

of demand and marginal costs. These are used extensively in nearly all aspects of fare planning and analysis. Therefore, management should have a good understanding of how they can be used and how they should be estimated.

Fare Elasticity of Demand

The demand for public transit is influenced by many factors, including the level of transit fares, the quality and quantity of service provided, and other factors outside the control of the transit agency. The elasticity of demand is a convenient measure of the relative responsiveness of transit ridership to changes in these individual factors. As a quantitative measure of relative change, the elasticity of demand is defined as the ratio of the proportional change in transit demand to the proportional change in the factor being observed. Thus, the transit fare elasticity will indicate the percentage change in transit ridership resulting from a one percent change in fares.

Transportation analysts have used several methods for computing the elasticity of demand, each resulting in slightly different numerical values. The four mathematical relationships used most often are:

Point Elasticity: $$\varepsilon_{pt} = \frac{dQ}{dF} \cdot \frac{F_1}{Q_1}$$

Shrinkage Ratio: $$\varepsilon_{sr} = \frac{Q_2 - Q_1}{Q_1} \div \frac{F_2 - F_1}{F_1} = \frac{\Delta Q/Q_1}{\Delta F/F_1}$$

Midpoint Elasticity: $$\varepsilon_{mi} = \frac{(Q_2 - Q_1)}{(Q_2 + Q_1)/2} \div \frac{(F_2 - F_1)}{(F_2 + F_1)/2} = \frac{\Delta Q/(Q_1 + Q_2)}{\Delta F/(F_1 + F_2)}$$

Arc Elasticity: $$\varepsilon_{arc} = \frac{\log Q_2 - \log Q_1}{\log F_2 - \log F_1}$$

where:

Q_1 = initial level of ridership

Q_2 = new level of ridership

F_1 = initial fare level

F_2 = new fare level

ΔF = changes in fares (new fares minus initial fares)

ΔQ = changes in ridership (new level of ridership minus inital ridership level)

$\frac{dQ}{dF}$ = derivative of the ridership demand function (Q) with respect to fares (F)

ELASTICITY

Price elasticity of demand is an economic concept built on the fact that rising prices dampen demand for transit services. Elasticities are expressed as the ratio of two percentages: the change in ridership (demand) divided by the change in price (fares). Thus, transit elasticities reflect the percentage change in ridership that can be expected from a one percent change in fares. For example, if fares have gone from 50 cents to 60 cents and ridership from 10,000 passengers to 9,500 passengers, then:

$$\text{Elasticity} = \frac{\text{Percent Change in Ridership}}{\text{Percent Change in Price}} = \frac{-5.0\%}{+20.0\%} = -.25$$

This indicates that, when prices increase 20 percent, ridership decreases five percent, for an elasticity of -.25. In other words, for a one percent increase in fares, ridership will decrease .25 percent.

Note that the elasticity here is a negative number, indicating that a increase in price has a negative impact on consumption. Notice also that the elasticity is less than one. When elasticity is less than one, demand is considered to be inelastic: An increase in the price of transit service does not produce a proportional decrease in demand for those services. (Elasticity of greater than one is considered elastic.) Most transit elasticities are still in the inelastic range.

Use of Fare Elasticities

Fare elasticities can be used to estimate how increases in fares for transit services will affect patronage and the resulting revenue. Given the inelastic nature of transit, increases in fares result in higher revenue and lower ridership. Conversely, decreases in fares result in higher ridership and lower revenue.

Industry-wide average fare elasticities are available for disaggregate market groups (time of day, trip type, system type, etc.) from several large and medium-sized properties. These elasticities can be used by transit systems to predict changes in ridership and revenue. Another approach in using elasticities would be for a transit property to estimate a system-specific elasticity value, as described below.

Methods of Estimating Fare Elasticities

Aggregated Before-After Comparisons

These simple methods compute fare elasticities (mid-point formula) by comparing data before and after a fare change for both ridership and real fares (adjusted for rises in the Consumer Price Index during the intervening period). The time periods selected for these comparisons must be ones of no (or negligible) change in other variables such as bus miles, route relocations, gasoline prices, and central city employment. Since the ridership impacts of fare increases are usually felt for 5-9 months after the increase (at that point, they stabilize) the time period should be long enough to observe those changes. In addition, the time periods compared should be comparable in terms of seasonal variations. For most purposes, a one-year (using the same months for both years) period both before and after a fare change is preferred.

Aggregated Time-Series Models

This method (which is far superior to the above) consists of collecting data for a 30-36 month period covering at least one fare change. Again, a period of 5-9 months after the fare change must be included. A regression equation estimating ridership as a function of fares, bus miles, gasoline prices, central city employment, SMSA income, and seasonal variables is estimated. The long list of non-fare variables is meant to control for extraneous influences on ridership. The fare elasticity is computed from the regression coefficient corresponding to the fare variable.[1] The attractiveness of this method is that the data are usually readily available (some of them from the transit property) and the statistical software can be a simple off-the-shelf package.

Disaggregated Cross Section Logit Models

This method is the most complex, albeit superior in terms of predictive capabilities because of its ability to isolate other non-fare influences. The unit of analysis is the individual transit trip, a complication that usually requires special and expensive surveys. Logit models predict demand by estimating the probability that an individual, drawn randomly from the population, will choose to use transit for a particular trip given the service attributes of transit (including price), the attributes of competing modes, and the socioeconomic characteristics of the person in question. The advantage of this method is that it produces disaggregate elasticities for different user groups.[2] Its disadvantage is that the data are costly to collect and the model is complicated and expensive to use.

[1] Michael Kemp. Planning for Fare Changes: A Guide to Interpreting and Using Fare Elasticity Information for Transit Planners, Urban Institute Working Paper 1428-05, December 1980.

[2] Thomas A. Domencich and Daniel McFadden. Urban Travel Demand: A Behavioral Analysis. American Elsevier Publishing Company, Inc., New York, 1975.

The point elasticity is derived from the actual transit ridership demand curve and can be evaluated at any point along the curve. Although it may be the most useful measure for fare planning since it is derived from the demand model, many transit analysts do not have enough information to develop such functions for the system as a whole, let alone for groups of riders.

The three remaining measures, therefore, are used more often to estimate elasticities from ridership and fare-level data corresponding to periods before and after a fare change. Of these, the shrinkage (or loss) ratio is perhaps the most common measure. Although there are numerous advantages and disadvantages to using all three elasticity measures, the midpoint and arc elasticity definitions will yield more consistent results for a transit agency, especially for large fare changes such as those occurring today.

The fare elasticity of demand is a useful concept in fare planning since it indicates the responsiveness of ridership groups to fare changes. For example, experience has shown that off-peak, short-distance, and shopping trips are more responsive to fare changes than peak-period, long-distance, and work trips. The more responsive the group, the larger the absolute value of the fare elasticity (e.g., off-peak riders with a fare elasticity of -0.60 are more responsive to fare changes than peak riders with a fare elasticity of -0.30).

The fact that nearly all fare elasticities lie in the range between zero and -1.0 is significant in fare planning. For values in this range, ridership response is said to be inelastic since a reduction in fares will lead to only a slight increase in ridership and, therefore, a reduction in total revenue; similarly, an increase in fares will lead to only a slight decrease in ridership and a net increase in revenue. For fare elasticities with an absolute value greater than -1.0, the ridership response is said to be elastic and the fare and revenue changes are inversely related. Thus, a value of -1.0 corresponds to the situation where the proportional change in fares produces the same proportional change in ridership and, thus, no change in revenue.

Although there are many limitations to the use of fare elasticities, management should use both to estimate the impacts of fare changes and to provide guidelines in fare levels. Because of the way the elasticity is defined, it can be used to estimate ridership changes resulting from increases and decreases in fares. Recall, however, that ridership is affected by many factors in addition to fares. Changes resulting from a fare increase, for example, may be offset by improvements in service or a reduction in the unemployment rate. Care must be taken in interpreting fare elasticity analysis.

Fare elasticities should also provide management and board members with guidelines on fare levels. As a basic policy, transit services should be priced taking into consideration both the costs of providing transit service and the responsiveness of ridership to fare changes. If your basic goal is to maximize revenue and ridership and costs are equivalent among ridership groups, transit service should be priced higher for ridership groups exhibiting small fare elasticities (i.e., from 0 to -0.30) and lower for those exhibiting high fare elasticities (i.e., from -0.30 to -1.0).[1]

Cost Considerations

Knowledge of transit operating costs is important for reasons other than the conventional financial accounting purposes of determining profits and tax liabilities. Not only is the knowledge of operating costs important for establishing cost reduction and productivity programs, but they are also of paramount importance in pricing decisions.

The word "costs" has many meanings and concepts. Indeed the kind of cost concept to be used in a particular situation depends on the nature of the decision to be made. In this discussion, two concepts of costs are introduced: average and marginal. Average cost is the cost per unit of output; it is calculated by dividing the total cost for the period by the number of passengers carried or vehicle miles provided. Marginal cost is defined as the addition to total cost caused by the production of an additional unit of service; it is calculated by dividing the change in total cost by the change in the number of passengers carried or the number of vehicle miles of service provided. Mathematically, these costs are expressed as follows:

$$\text{Average Cost} = \frac{C_1}{Q_1} \text{ and } \frac{C_2}{Q_2}$$

$$\text{Marginal Costs} = \frac{C_2 - C_1}{Q_2 - Q_1}$$

[1]It should be cautioned that this discussion does not necessarily reflect the social goals of a transit agency.

where:

C_1 = initial total costs

C_2 = new total costs

Q_1 = initial level of ridership

Q_2 = new level of ridership

In the presence of expense items that are not sensitive to changes in the level of service provided, pricing according to average costs leads to lower ridership. This is particularly true for transit systems, some of whose costs are either fixed (such as, administration, rent, and office insurance) or only semivariable (for example, garages and advertising). Moreover, average costs are often based on arbitrary allocations designed more for political funding purposes than for pricing decisions.

The significance of marginal costs in pricing decisions is well understood in the business world, where executives attempt to target on higher profits by setting prices at levels where marginal revenues equal marginal costs. A variation of this marginal-cost pricing rule has been implemented for public agencies and regulated industries. This rule (called the Ramsey or inverse elasticity rule) states that if the goal is to provide the greatest benefit to consumers within a budget constraint, then the agency should set prices (fares) so that percentage deviations of prices (fares) from marginal costs are proportional to the inverse of the price (fare) elasticities of demand referred to earlier. Thus, by knowing the demand elasticities and the marginal costs of providing service, transit management can determine the fares that will maximize passengers for a given budget constraint.

Marginal costs are also important in the design of fare structures, since transit operating costs differ by time of day and -- to a lesser extent -- by route length. Unfortunately, marginal costs are difficult to estimate. Although numerous techniques are available for estimating marginal costs, the simpler the estimation technique, the worse the approximation. This manual refers to "approximate marginal cost" in order to recognize the difficulties in estimating the true marginal cost of transit service. It should be clear to the reader, however, that average costs should not be used in pricing decisions.

5

REVIEWING FARE OPTIONS

Task 1 Prepare Organization for Fare Planning	→	Task 2 Gather and Manage Data	→	Task 3 Review Fare Plan Options	→	Task 4 Select Appropriate Fare Plan	→	Task 5 Implement and Evaluate Fare Change

5

REVIEW OF FARE OPTIONS
(TASK 3)

Fare planning in the past has been constrained by the technology for collecting passenger fares. The design of a fare structure, for example, was limited by the type of fareboxes installed on the bus, regardless of the merits of distance-based or time-based fare concepts. During the past few years, however, more attention has been paid to new methods of fare collection -- both hardware and operations -- and the varied fare structures they permit.

This chapter reviews fare structure options, fare collection methods, and promotional fare policies. The purpose of this review is to identify the range of options available, highlighting their advantages and disadvantages. The process of actually selecting a new fare plan is covered in the next chapter.

FARE STRUCTURE OPTIONS

Clearly, the most complex element in fare planning is deciding the structure of the fare system. For simplicity and low cost, most transit agencies have traditionally relied on a single fare for all users. For revenue and equity reasons, however, reliance on a flat fare structure in some cities may not be in the best interest of either the transit agency or its patrons. This section describes the advantages and disadvantages of flat fares and the most common fare structure alternatives. Included in this discussion are the following:

- flat fares,
- distance-based fares,
- time-based fares,
- quality-based fares, and
- special user fares, and
- transfer charges.

The basic feature of each fare structure is summarized in Table 5-1.

Table 5-1

FARE STRUCTURE ALTERNATIVES AND THEIR BASIC FEATURES

Fare Structure	Basic Feature
Flat Fare	One fare for all trips.
Distance-Based Fare	Fare depends on distance traveled.
Time-Based Fare	Fare depends on the time when the trip is taken.
Quality-Based Fare	Fare depends on the quality of the service provided.
Special User Fare	Fare depends on the client group or other trip category.
Transfer Charge	Additional charge for transfers made.

Flat Fares

The most common fare structure in use today, flat fares are also the easiest to understand and the least costly to implement. The simplicity is based on the fact that each transit rider pays the same fare no matter how far he rides, when he rides, or what service he uses. Thus, the user benefits because of its ease of comprehension; the transit operator benefits because of being able to apply a simpler and more understandable fare collection system that minimizes operating and administrative costs.

Unfortunately, flat fare structures have their disadvantages. First, they reduce management's ability to maximize farebox revenues. Since in most locations short-distance and off-peak riders are more responsive to fare changes than long-distance and peak-period riders, management would be able to generate more revenues with no loss in ridership by requiring different fares from each of the two groups.

In systems where there are significant differences in the marginal costs per mile for different categories of trips, flat fare structures are also inequitable. For example, it is often difficult to set a fare level that is simultaneously acceptable to the short-distance rider, yet high enough to cover a reasonable portion of the operating costs. Long-distance riders gain an unfair advantage over short-distance riders because they are able to ride at a lower cost per mile.

Distance-Based Fares

Perhaps the most common alternative to flat fares, and one that is popular in large transit systems, is to charge users in some proportion to the distance traveled. This can be rationalized on the grounds that the marginal cost of servicing long trips is greater than the marginal cost of servicing short trips. In addition, long-distance riders tend to be less responsive to fare changes than short-distance riders.

There are essentially two ways of charging users according to the distance traveled. The first is to identify the rate at which riders should pay for each mile or group of miles traveled. This method, known as graduated fares, is very difficult to administer without the aid of computerized fare collection equipment. Graduated fares are most common on modern commuter railroad and rapid rail systems.

The more common method of charging fares by distance traveled is to superimpose a zone structure on the transit network. The price of a trip will therefore depend on the number of zones crossed. Such a zone structure can be designed in any number of ways, as shown in Figure 5-1. The most common approach in large cities is to design a series of concentric zones, with the center zone incorporating the entire city. Since, in most large urban areas, over 75 percent of public transit trips take place within the city limits, this type of zone system is more akin to a flat fare structure and should not be adopted if a true distance-based fare structure is desired. It follows that, the finer the zone structure, the more equitable the fare structure will be to the rider.

The strength of the concentric zone structure lies in its application to a bus system where the route pattern is largely radial. If, however, there are a significant number of crosstown routes, users on such routes are likely to pay less for a given distance traveled than those who use the radial services. An additional weakness of the concentric zone system is that riders who take short trips across zone boundaries will pay for trips at a much higher rate per mile than those traveling comparable distances wholly within the limits of a zone. This problem can be alleviated by creating minimum fares good for at least two zones of travel.

Because of its ease of administration and its pricing peculiarities, the concentric zone system adopted by the Dallas Transit System (DTS) may be of interest to some transit agencies. Transit fares in the Dallas three-zone system are based on where the passenger boards and alights and not specifically on the distance traveled. Thus, a passenger boarding in the outermost zone pays the highest fare, regardless of whether the patron travels to the center city, the second zone, or only within the third zone. A passenger boarding in the center zone pays the fare applicable to the zone where he disembarks. The Dallas fare structure is therefore easy for passengers to understand and drivers to enforce. The structure is based on the premise that service to outlying areas is most costly to provide, trip lengths are the longest for third-zone patrons, and third-zone riders exhibit the lowest elasticities of demand (that is, they are least sensitive to fare changes).

An alternative to the concentric zone concept is to superimpose a grid system over the transit network. A series of concentric zones can be maintained if the predominant route structure is radial, or the zone can be rectangular in shape. The strength of either grid arrangement is to produce a fare structure that is more equitable for all trip distances, irrespective of whether the rider is using a radial or crosstown service. The grid zone concept's greatest weakness is its complexity and its difficulty in administration and enforcement. Moreover, the grid system will still result in a high cost of travel for short trips across zone boundaries unless the fare scale allows at least two zones' worth of travel for the minimum fare.

Finally, it is possible to design a zone fare structure for individual routes, provided there is little transferring from one route to another. The strength of a system of individually tailored zones for different routes is that

each route's zones can be designed to achieve a high degree of cost equity among users and a maximization of revenue-earning miles. Unfortunately, a system of unique zone boundaries is both difficult to enforce and to understand.

Time-Based Fares

A time-based fare structure is one in which the fare paid depends on the time the trip is taken rather than on the distance traveled. As with a distance-based fare structure, the rationale for time-based pricing involves both cost and market considerations. During peak periods, for example, the cost of providing a transit trip is approximately 50 percent higher than during off-peak hours. Peak riders also tend to be much less sensitive to price changes than off-peak riders.

Although time-based fare structures are operationally easier to implement than distance-based fares, time-based fares do create a problem of enforcement for the bus driver. Often, passengers will argue with the bus driver over the correct fare when the boarding takes place at or near the time the fare changes. Small transit agencies can get around this by identifying specific runs as either peak or off-peak runs.

In addition to charging a different fare depending on the time of day, some transit agencies have implemented reduced-fare programs during the evening hours and on weekends since riders during these periods are sensitive to price changes. The net effect of those programs, however, has been to reduce farebox revenues, given that fare elasticities of demand during these periods are still lower than one.

Quality-Based Fares

Research has repeatedly shown that transit riders, especially commuters and high-income users, are more sensitive to service changes than they are to price changes. This suggests that a ten percent increase in service or service quality would attract more riders than would be lost by a ten percent increase in fares. Reliability, comfort, and travel time are the attributes most riders would like to improve and for which they are willing to pay. For this reason, many transit agencies offer special, high-quality services, such as express and subscription services.

A quality-based fare structure is one in which several levels of service are provided and separate fares are charged for each level. The fares established for each service are based on the cost of providing the service and the relative elasticities of demand for each service group. For a quality-based fare structure to be successful, it is imperative that the express or premium service be substantially superior to local service. Too often, transit agencies attach a premium price to services that do not significantly improve riding comfort or running time.

Special User Fares

In addition to one of the fare structures already discussed, most transit agencies adopt separate fare levels for specific user groups. Off-peak half fares have been implemented for the elderly and handicapped, for example. Special rates are generally also provided for children and students.

It is important to note that these fare structures are often not justified on the grounds of equity or cost, but rather are adopted in response to specific subsidies (e.g., school board) or political policies. Care must be taken that transit fare-reduction policies be targeted specifically toward the group in question. This subject is discussed more in the next chapter.

Transfer Charges

Few transit agencies are able to design a route structure such that no transit trips would require a transfer. The origins and destination of urban travel are so diverse that management's only hope is to minimize the number of transfers and the time in transferring. How management handles the transfer is a key element in fare structure design.

No Transfer Policy

In a system without transfers, the transfer charge, in effect, is the full fare. This policy is used in very few transit agencies because it reduces ridership and is viewed as inequitable. Most transit managers question the equity of charging one rider two fares for a single trip simply because the

rider's travel pattern does not coincide with the route structure. A no-transfer policy, however, is simple to understand and enforce, reduces cost, and eliminates transfer abuse.

Free Transfer Policy

With a free transfer policy, a transit rider is given a transfer on demand at no cost to the user. Depending on the regulations regarding transfer use and the level of driver enforcement, transfer abuse can be a problem. The most common form of abuse occurs when passengers obtain a free transfer and sell it or give it to a friend who is then able to ride free. A free transfer policy has the advantage of being easy to understand and more equitable than a no-transfer policy.

Reduced-Fare Transfer Policy

Most transit agencies use transfer slips to provide a reduced-fare transfer. The most common method is requiring passengers to pay for transfers when the slip is received on the first bus. As an attempt to reduce the transfer abuse mentioned above, some agencies require payment of the transfer charge on the second bus. The effect of this policy, however, is to create two separate monetary transactions. This arrangement does eliminate user dissatisfaction caused by purchasing transfers and then possibly not using them.

Temporal and Directional Transfer Policies

In addition to determining how the transfer charge is going to be collected, transit management must identify the temporal and directional policies governing transfer usage. Most transit agencies provide the user with 30 to 60 minutes during which the transfer must be made. Some agencies provide as much as three hours of transfer time and actually encourage users to make intermediate stops. A few systems do not issue transfers, but do sell day passes for twice the base fare, allowing unlimited riding for the entire day. For the purpose of transferring, day passes function much like free transfer slips with no directional or temporal limitations.

The directional limitations generally placed on transfers are designed to eliminate multiple trip taking. For this reason, most transit agencies do not

allow the transfer to be used for backtracking. Thus, only buses moving in certain route directions can be boarded with a specific transfer. To encourage downtown shopping and other activities, transfers can be used as CBD-zone passes, particularly during the midday.

FARE COLLECTION METHODS

An integral part of fare planning is deciding how transit riders will pay the fare. Decisions of this nature must be made in conjunction with establishing a fare structure since certain fare structures preclude the use of several payment methods. As a resource in identifying the range of fare payment methods available to transit management, this section of the chapter reviews the principal fare payment options, highlighting selected features. Note that a transit agency's fare payment policies might rely on a single fare method (for example, cash fare payment only) or, more often, on a combination of methods.

Cash Payment

The basic method of fare payment by nearly all the transit agencies operating in the U.S. is cash, both with coins and dollar bills. Although the cost of collecting, sorting, and counting coins is relatively low, the cost of handling dollar bills is very high. Accommodating the dollar bill has increased both labor and capital (through dollar-bill accepting fareboxes) requirements. Currently, transit agencies spend between one and three percent of total operating costs on fare collection, 80 percent of which is labor.

As fares increase beyond the one dollar level, alternatives to cash fare payment must be adopted to minimize fare collection costs and fare abuse. The most popular alternative to cash fare collection is the prepayment of fares.

Fare Prepayment

Generally referred to as prepaid passes, commuter tickets, and flash passes, transit fare prepayment is defined as any method of advance fare payment. Thus, fare prepayment involves purchasing evidence that can later be verified as a substitute for cash payment for transit rides.

The most common categories of fare prepayment in use today include tokens, tickets, punch cards, permits, and passes. These categories vary primarily according to boarding procedure and period of validity. As shown in Table 5-2, tokens, tickets, and punch cards can be used for a limited number of rides. Permits and passes generally do not have trip limitations, but are time limited. Other selected features of fare prepayment plans are shown in the table.

Tokens

Tokens are metal, coin-like disks dropped into a turnstile at the entrance to a rapid transit station or into a farebox on a transit vehicle. They are the fare prepayment form most similar to cash since they resemble coins. Tokens are also the only form of fare prepayment that must be minted instead of printed. Generally made of brass or less expensive aluminum, tokens range in size from 0.65 to 1.51 inches in diameter.

Unlike other forms of fare prepayment, tokens are reusable and can last for an indefinite period of time. They usually do not expire unless a fare change necessitates replacing all tokens in the system. This is done primarily to avoid hoarding of tokens before a fare change.

Tickets

Tickets are cards or pieces of paper given to the conductor or dropped into the farebox when a trip is taken. In self-service systems, tickets are validated at wayside locations or on-board the transit vehicle by the passenger. The validated ticket is kept by the passenger and then shown to the inspector on request. Some tickets have stubs that are torn off by the driver and returned to the passenger as a receipt.

Each ticket is usually good for one ride or for each zone in which a trip is taken. In systems with multiple fare categories, tickets are often available in a variety of denominations. In addition, tickets are usually sold in books of 10, 20, 40, or 45 tickets, in strips of 10 or 12, or individually from a ticket roll. Tickets usually do not carry expiration dates. One problem with tickets is that they may jam farebox machines that are not specifically designed to handle this type of fare prepayment plan.

Table 5-2: SELECTED FEATURES OF TRANSIT FARE PREPAYMENT PLANS

<table>
<tr><th>Fare Prepayment Category</th><th>Period of Validity</th><th>Quantity of Rides</th><th>Pricing Policy</th><th>Time of Day or Week</th><th>Client Group</th><th>Select Transit Services</th></tr>
<tr><td><u>Trip-Limited</u>
• Tokens
• Tickets
• Punch Cards</td><td>Usually Provided Without Expiration Date</td><td>• 1 trip
• 10 trips
• 20 trips
• 40 trips
• 40+ trips</td><td>Explicit Discount Policy
(Discount independent of usage, with larger plans offering larger discounts)</td><td rowspan="2">• Peak Hours
• Off-Peak Hours
• A.M. or P.M. Peak, with Off-Peak Hours
• Weekends
• Weekdays
• Unrestricted</td><td rowspan="2">• General Public
• Commuter
• Shopper
• Student
• Elderly and Handicapped
• Tourist
• New Resident
• Other Group</td><td rowspan="2">• Multi-Modal
• Mode-Specific
• CBD Service
• Express Service
• Park and Ride Service
• Other Special Service</td></tr>
<tr><td><u>Time-Limited</u>
• Permits
• Passes</td><td>• Daily
• Weekend
• Weekly
• Monthly
• Semester
• Annually
• Permanent</td><td>Usually Allowing an Unlimited Quantity of Rides</td><td>Implicit Discount Policy
(Discount dependent on usage, with longer plans offering larger discounts)</td></tr>
</table>

Punch Cards

Punch cards are cards or slips of paper with areas in which holes are punched by the driver or conductor -- an operation that increases dwell time and thereby operating costs. Printed usually in the size of a credit card, punch cards are functionally equivalent to most tickets and tokens. One hole is punched per ride or zone in which a trip is taken. When the specified number of holes has been punched, the card no longer has any value. Punch cards have often been called "punch tickets," "multiple-ride tickets," "commutation tickets," and "punch passes."

A variation of the punch card -- and for that matter any multiple-ride ticket format -- is the magnetic farecard. Implemented in several modern rapid rail systems in this country and in Europe, the magnetic farecard requires sophisticated technology that is not yet practical for use on bus systems (one company will begin production of card readers for use on buses very soon). With the magnetic card, a passenger purchases a certain value that is recorded on the magnetic tape portion of the card. To take a trip, the rider places the farecard into the card reader, which identifies the origin of the trip. When exiting, the farecard is again inserted into the reader, which computes the fare for the trip, deducts the value from the card, and returns the card to the user. Although card readers would have to be placed in both the front and back of the bus in systems with distance-based fares, the system would only require one unit per bus if flat, time-based, or quality-based fares are used. The system could also incorporate unlimited-ride passes or permits as described below.

Permits

Permits are wallet-size cards that passengers display at the time of boarding. The permit allows the individual to travel at a reduced rate until the permit expires. A photograph or another method of identification on the permit is usually used to limit use of the card to the intended person. Since permits are usually used for long periods of time, the cards are often made of heavy paper stock and coated in plastic.

Permits are ideal for targeting lower fares to special groups, such as students, the elderly, and the handicapped. For these groups, the permit is provided for a nominal fee or free of charge and is valid for one year or longer.

However, recently there has been a renewed interest in monthly permits for the general population as an alternative to the monthly pass because of their revenue potential.

Passes

Passes are similar to permits in appearance, but generally do not include the photograph of the user because of the cost. Like permits, passes must be displayed to the driver when boarding. However, passes differ from permits in that the passenger rides as many times as desired without paying any additional fee until the pass expires. This affords the user the convenience of not having to carry cash to make a trip. Pass validity periods can vary considerably, the most common being daily, weekly, monthly, semester, and annual. In some cases, passes for privileged users have no expiration dates.

In transit companies with zone fare structures, passes specific to zones can be made available. However, since most passengers travel in the central zone of zone fare systems, a central zone pass can be used as a permit for trips into the outer zones. Thus, differential fares can be charged with only one version of the prepayment instrument.

Fare Postpayment

Postpayment methods have been used only in demonstration projects sponsored by the U.S. Department of Transportation. This method of payment has several serious drawbacks. First, buses would have to be equipped with credit card readers, which have yet to be proven effective on a systemwide basis. The cost to the agency would be high, cash flow would be impaired, and the opportunities for fraud and misuse are great. In addition, the system would require an elaborate data processing and billing system.

Self-Service Fare Collection

Used extensively in Europe, self-service fare collection is now operating in Portland, Oregon, and on the light-rail line in San Diego. Under this system of fare collection, riders purchase prepaid tickets or passes from agents, vending machines, or for a premium price, from the bus driver. Once on the bus,

the passenger must validate the ticket, thereby ensuring that a ticket (or pass) of sufficient value has been purchased. To guard against fraud, these systems employ a series of roving inspectors who check for valid tickets and passes. Those with invalid tickets or passes are fined.

Although an additional capital cost for validators and vendors (optional) is incurred, the benefits of self-service fare collection may be great. Differential pricing policies may be instituted to increase passenger revenues and dwell times can be significantly reduced, especially if both doors are used for boarding as well as alighting.

PROMOTIONAL FARE POLICIES

In addition to developing fare policies for collecting passenger revenues, transit managers can use fares as promotional tools for specific marketing purposes. Promotional fare policies are generally provided as temporary fare reductions during the promotional period for the purpose of increasing transit patronage over the long term.

Free- or reduced-fare promotions are often undertaken in cooperation with local businesses or radio stations. The promotions may take several forms and can be targeted to increase certain types of ridership. The incentive may vary from a slight fare reduction to total fare removal and may be presented in several different ways: on one specific bus, on all buses or alternating buses, and for periods ranging from one hour to a year or longer.

Promotional fare incentives provide excellent tools for engaging private sector support for transit services by soliciting their assistance in marketing or financial subsidization. In addition, when promotional fare incentives are used strategically, they can aid in maintaining and managing transit ridership. Managers must be aware, however, that, if promotional fares are not underwritten by the business community or by specific public organizations, revenue losses will result. As a general rule, the ridership generated during promotional fare periods is not retained sufficiently after the fares are reinstated at their normal level to offset lost revenue during the promotional period.

6

SELECTING APPROPRIATE FARE PLAN

Task 1 Prepare Organization for Fare Planning	→	Task 2 Gather and Manage Data	→	Task 3 Review Fare Plan Options	→	Task 4 Select Appropriate Fare Plan	→	Task 5 Implement and Evaluate Fare Change

6

SELECTING THE APPROPRIATE FARE PLAN
(TASK 4)

The purpose of fare planning is to identify what is wrong and what is right about the fare policies that currently exist and to suggest how those policies can be improved. The outcome of the planning process, therefore, is a proposal outlining a series of fare changes that, when implemented, would move the transit company toward its stated goal.

This chapter presents a sequence of five steps that identify the specific fare changes that should be recommended to the transit board for approval. These tasks include evaluating existing fare policies, establishing appropriate evaluation criteria for analyzing options, selecting fare options to test, evaluating four or five fare options, and recommending a specific fare plan to the transit board.

STEP 1: EVALUATE EXISTING FARE POLICIES

The best place to start in developing appropriate fare options to test is with an evaluation of current fare policies. This should be done by first defining the problems that currently exist with the fare structure. Why, for example, is management interested in changing the fare? Are passenger revenues too low? Is the fare structure too complex to understand? Has there been excessive fraud and theft?

The most frequent answers to these questions involve the need to raise farebox revenues, create a more equitable fare structure, and simplify the operational complexity and cost of the fare collection system. Answers to the above questions will flow from an analysis of what is wrong with existing fare policies.

An inventory of existing conditions should be performed to assist in that determination. The inventory should include at least the following six areas.

- Existing Fare Structure and Fare Levels: The staff should conduct an inventory and provide a description of the existing fare structure and the fare levels for each fare-paying group. Special fare categories -- such as park-and-ride services, downtown services, elderly and handicapped reduced fares, and student reduced fares -- must also be inventoried and their fare levels recorded for analysis.

- Existing Ridership and Revenue Levels by Fare Category: After the fare structure and the fare levels have been reviewed, the next step is to provide ridership and revenue data for each fare category in a manner that can support the development of fare options. Ridership and revenue data should be developed for weekdays and weekends, and disaggregated by zone or distance and by time of day to facilitate consideration of alternative fare structures. The average fare paid by each type of passenger should also be noted.

- Transfer Levels and Transfer Policies: Given the adverse effects of transfers on transit ridership, the level of transferring should be monitored. Ridership is affected by transferring because of the wait time required for the transfer. In addition, the price of transfers has an important revenue and ridership effect. A problem in some transit properties is transfer abuse. When the operator does not physically take possession of the transfer to inspect it, punch it, or validate it, the opportunity for abuse is great.

- Fare Collection Equipment and Processing: Fare collection equipment is intimately tied to the fare structure. If the fare collection equipment is subject to significant equipment failure or if the processing of fare collection revenue results in appreciable theft, then the fare collection system, including its closely linked fare structure, needs to be reconsidered. The problem of equipment failure occurs often in automatic fare collection systems.

- Amount of Fraud and Error: Error in paying the correct fare occurs most often when the fare structure is not easily understandable by the rider. It is important to determine through on-board surveys how many riders are paying the correct fare and if there are any complaints regarding fare complexity. Fraud -- voluntary or involuntary -- will always be present. However, when revenue losses due to fraud, error, and theft exceed three to five percent of total passenger revenue, a reevaluation of the fare collection policies should be undertaken.

- Existing Costs of Providing Different Services: The costs of providing transit services for each fare category must be identified to the extent possible. These costs should be marginal (or quasi-marginal) costs rather than average costs since, as discussed earlier, marginal costs are the pertinent figures to use in planning fare changes. Average costs should also be made available if the cost recovery ratios for different market groups are going to be compared.

An inventory of the existing fare collection system and performing the analysis just suggested will provide management and staff with two immediate resources. First, the important numbers and figures concerning existing conditions will be available for comparison with new options that might be tested. The value of any fare change can be measured by how well it improves the current situation.

The second benefit of this analytic effort is that it will help identify what is right and what is wrong with existing fare policies. Many problems are often difficult to detect until such an analysis has been performed. Thus, the list of problems identified at the beginning of this exercise can be augmented with new problems that may have been discovered.

Understanding the issues relating to existing fare policies provides the basis for the steps that follow. The criteria used for evaluating alternative fare options will be selected based on those issues. Management and staff will also be in a better position to identify fare options that are reasonable and worthy of being tested. Thus, the foundation for the detailed analyses that follow will be set.

STEP 2: ESTABLISH EVALUATION CRITERIA FOR ANALYZING OPTIONS

Before alternative fare plans can be evaluated, a set of criteria must be established that will determine how each plan will be judged. Evaluation criteria are the yardsticks against which the relative value of one plan versus another can be measured. Which evaluation criteria to use will depend on the results of the analysis undertaken in the previous step and the specific fare policy objectives of the transit company.

For major fare changes, at least five classes of evaluation criteria have been used, including:

- revenue-generation criteria,
- ridership-generation criteria,
- fare equity criteria,
- operational feasibility criteria, and
- socioeconomic and environmental criteria.

The purpose of this step is first to decide which criteria should be used in evaluating alternative fare plans. Each criterion should then be quantified by setting established targets with minimum and maximum values identifying acceptable ranges.

Revenue-Generation Criteria

Perhaps the most important reason for a fare change is to generate additional passenger revenues. As operating costs rise and subsidies fall, a greater share of the financial support of transit operations comes from the farebox.

Revenue requirements are usually determined annually as part of the budget and financial planning review process. In this context, it is useful to select the farebox revenue requirement by recalling the triangular relationship that exists among farebox revenues, outside subsidy support, and the cost of transit service. As subsidy support diminishes, fares or service levels must be adjusted to maintain the balance between revenue and cost.

The first task in identifying the revenue-generation criteria is to forecast the level of external subsidy support that will be available from local, state, and Federal sources, as well as other sources, such as dedicated taxes. Forecasts should be made quarterly over one to two years. Once such forecasts have been made, the next task is to project the costs of running the transit system for a projected level of service. However, the costs and service levels should not be decided in isolation from fare decisions, since these decisions have some degree of interdependence. What emerges from this analysis is the development of a few options combining levels of service, cost, and farebox revenues that are compatible with the external subsidy level available. A specific revenue-generation target can now be set, as well as an acceptable range that may be quite narrow. This range of acceptable levels of revenue generation becomes one of the criteria used to judge fare plan options.

Ridership-Generation Criteria

Intrinsically linked to the revenue criteria just set are ridership-generation criteria. The higher the target set for additional revenue, the lower the acceptable ridership target. In light of a revenue growth target of 10 percent, for example, it will be quite difficult for a transit agency to meet a similar growth rate for ridership. Management, therefore, should establish ridership targets that can be met given the revenue target already established. The only way to diminish the importance of the revenue target is to reduce service costs or increase outside subsidy levels.

Ridership-generation criteria can be established for the system as a whole and by market group. If management has clear policy objectives with respect to the ridership levels on specific routes, time periods, or service areas, these objectives can be used to help establish ridership criteria. The criteria should specify a target and an acceptable range.

Fare Equity Criteria

The concept of equity is central to developing a rational, just, and acceptable fare policy. Two alternative views of equity are usually discussed: the ability-to-pay principle and the benefit principle. In its application to transit fare policy, the ability-to-pay principle claims that transit is a social service and its fares should be set to favor those least able to pay. On the other hand, the benefit principle claims that fares should be paid in proportion to the benefits received. Following this latter view, equitable fares result when all users have the same ratio of fares per trip mile to cost per trip mile. A simpler approximation would be to equalize fares per trip mile. Because of the different subsidy levels provided by different political jurisdictions -- with suburban localities contributing more subsidy per trip mile than central cities -- the equity argument is sometimes extended to cover the incidence of all taxes (income, sales, property) levied to defray the costs of transit.

While each transit agency should follow its defined goals and objectives regarding fare subsidization, this manual follows the benefit principle in the analysis of equity. Fare policy has been found to be an inefficient tool for distributing income to the needy. This is because fare policy is too general

in scope and cannot usually be targeted solely to the needy. Consequently, fare discounts are often extended to the non-needy who have the resources to pay the full fare. In general, fare policy should not be used to redistribute income except for groups favored by law, such as the elderly and handicapped.

From the analysis of the existing fare structure, management should be able to create a series of tables comparing the ratio of fares per trip mile to cost per trip mile (or simply fares per trip mile) for different transit markets. Passengers of different trip lengths, traveling in different service areas, and traveling during different time periods are the suggested market groups for this comparison. These tables will indicate which market groups are paying a larger share of transit costs. Specific criteria can then be established with the objective of reducing any inequities. As with other evaluation criteria, management should establish a target equity ratio and an acceptable range around this target value.

Operational Feasibility Criteria

If the fare is going to be changed, the new fare structure must meet some basic operational criteria. First, the fare structure must be convenient for passengers. That is, the fare structure should be easily understood, the number of coins required for a typical transaction should be small, the transfer mechanism should be simple, and the number of prepaid fare plans should be small, with each plan readily available through outlets and ticket machines.

Second, fare collection costs should be minimized. As a general rule, fare collection costs should not exceed five cents per passenger trip. Fare policies that lead to higher costs than this rule should be closely examined for streamlining. To help minimize operating costs, fare policies should not delay passenger boarding and alighting.

Third, the fare structure should support the collection of passenger data, particularly in view of UMTA's Section 15 reporting requirements. Although no major problems arise in flat fare systems, it is difficult to estimate ridership levels in other fare structures and for pass programs unless on-board surveys are conducted, registering fareboxes are used, or automatic passenger counters are employed.

Finally, the fare plan finally adopted should minimize fraud, theft, and fare abuse. Fraud and fare abuse can be reduced by simplifying the fare structure. Theft is usually avoided by limiting the number of cash transactions.

Each operational criterion should be specified as clearly as possible. Fare collection costs, fare abuse, and theft can be quantified and targets can be set based on current conditions. The criteria should identify what is acceptable and what is not acceptable from an operational standpoint. A ranking system may also be used to score the various plan options along each of the criteria mentioned above.

Socioeconomic and Environmental Criteria

In addition to the above criteria, fare plans are sometimes designed to meet a variety of other goals. Examples include providing reduced fares for the elderly and handicapped during off-peak hours, meeting clean air standards and energy conservation goals by encouraging shifts from auto use, promoting the use of idle capacity during off-peak hours, and fostering the development of the central business district. It is safe to say that, with respect to fare policy, most of these goals are of secondary importance. Transit fare policies generally have small leverage on the achievement of these socioeconomic goals.

STEP 3: SELECT FARE OPTIONS

Once the background work has been performed, the transit agency will be ready to select different fare options that can be analyzed and evaluated. The four specific decisions that have to be made are:

- which fare structures to test,
- which fare collection methods to use,
- which fare prepayment plans to offer, and
- which promotional fare programs to implement.

Selecting Fare Structures

If a major fare change is being considered, several fare structures should be tested. Unfortunately, no simple rules exist for selecting fare structures. Creativity is required along with a clear understanding of what is wrong with the current fare structure, what is applicable in the region, and what is politically feasible. Most of these aspects of the current transit system should be understood at this point in the fare planning process.

The basic fare options that can be tested include flat fares, time-of-day fares, zone- or distance-based fares, and other options including quality-based fares. Each fare structure has its own benefits and disbenefits. As a general rule, the more complex fare structures (time-of-day and distance-based fares) produce more revenue with a smaller loss of ridership and are most equitable. However, they can be confusing to users and more costly to implement.

The present practice of approaching fare design from the political viewpoint of defining fares in terms of the lowest common demoninator of what the average passenger is willing to pay is myopic, since it fails to tap the potential for pricing according to the perceived value of the transit service. Consumer research on transit has consistently shown the rider's perception that transit service does have a value and that the clientele is willing to pay for clean, fast, and convenient service. Consumer research results also show that improving service is perhaps more important than maintaining low fares for attracting or maintaining ridership. These findings suggest a need for different services and different prices to take advantage of riders' perception of service need and value. The few communities that provide scant service to a homogeneous group of riders are the only ones that do not have to worry about multiple service options and, thus, differential pricing. However, if other systems are truly in the business of providing the most service to the most people for a given level of subsidy, then those systems should opt for differential pricing policies.

Development of differential pricing structures requires an active market research program to identify segments of the transit market and their response to fare and service changes. In addition, an entrepreneurial approach to the development of transit services has to be combined with political flexibility, objectivity, and freedom to vary fares in response to changing economic conditions.

It is conventionally understood that transit markets vary in their responsiveness to fare changes. Short-distance and off-peak riders are generally more responsive to fare changes than long-distance and peak-period riders. Therefore, by designing fare structures that consider different traveler reponses to fares, it is possible to raise revenues with less sacrifice of trips lost.

Critics of flat fare structures claim that flat fares, by ignoring differences in elasticities of traveler responses to fare changes, raise less revenue with greater sacrifice of trips lost than would be the case with distance-based

or time-of-day fare structures. Flat fares are also less equitable if trip lengths vary considerably.

On the positive side, however, flat fare structures are easier to administer. Time-of-day and distance-based fares require driver training and a more conscious effort on the driver's part to supervise the payment of correct fares. Flat fare systems also result in faster boardings than do more complex fare systems.

A final factor not usually highlighted in the discussion of alternative fare structures is the issue of fraud. Fare experiments involving changes from distance-based fares to flat fares have uncovered a significant element of fraud (both involuntary and voluntary) in distance-based fares, as well as other significant costs, such as increases in dwell time, driver time, and administrative costs. For distance-based and time-of-day fares to overcome their greater administrative costs, significant differences must be present in the elasticities found for short vs. long trips and peak vs. off-peak trips. Only when appreciable elasticity differences are present will enough revenue be raised to cover administrative costs.

Based on this discussion, it is possible to make the following generalizations concerning each fare structure alternative:

- Flat fares: While easy to apply and administer, they suffer from their adverse effects on equity and revenue generation.

- Time-of-day fares: This fare policy involves a surcharge for peak service, a surcharge justified by the greater costs and lower elasticity of demand during the peak period. These fare structures are superior to flat fares in terms of equity and revenue potential, but they are slightly more expensive to administer.

- Distance-based fares: Transit fares graduated by distance provide the best features in terms of equity and revenue-generation potential in those transit systems with appreciable differences in elasticities between short and long trips. However, these fare structures are inconvenient to users and lead to fraud and to higher operating costs due to slower boarding times.

- Quality-based fares: There is evidence that transit riders, especially high-income transit riders, are willing to pay considerably greater fares for high-quality services, such as express or subscription service. Evidence of the opportunities offered by these fare structures is provided by several companies providing profitable long-haul express commuter service in large metropolitan areas in the East and Midwest. By charging higher fares to the long-distance high-income commuter, quality-based fare policies remove some of the inequities of flat fare systems, while having high revenue-generation potential.

- Special purpose fares: These fares include off-peak half-fares for the elderly and handicapped, student fares, etc. While removing inequities against the particular user groups, these special purpose fares can significantly reduce passenger revenues.

As already mentioned, designing a fare structure that is equitable to all users will most likely be revenue efficient, but complex and costly. Any recommendation about the design of a fare structure, therefore, must weigh the benefits of increased equity and revenue with the costs. Many fare structures can be designed and many program elements (special fares, fare prepayment, etc.) must be considered. A summary of how the major fare structures rank according to their effects on revenue and ridership generation, equity, passenger convenience, costs, and fraud is presented in Table 6-1. A distinct trade-off can be seen between revenue efficiency and equity on the one hand and convenience and cost on the other. Less complex fare structures, while easy to apply, suffer in that they are less efficient and less equitable; the opposite is true of distance-based fare structures.

Table 6-1

SUMMARY OF FARE STRUCTURE SYSTEMS EFFECTS

Fare Structure	Revenue/ Ridership Generation	Equity	OPERATIONAL SIMPLICITY			
			Passenger Convenience	Collection Costs and Complexity	Operating Costs and Boarding Times	Fraud Avoidance
Flat Fares	Poor	Poor	Excellent	Excellent	Excellent	Excellent
Time-of-Day Fares	Good	Excellent	Good	Good	Good	Good
Distance-Based	Excellent	Excellent	Poor	Poor	Poor	Poor
Quality-Based	Fair	Excellent	Good	Good	Excellent	Excellent

The choice of a fare structure and its appropriateness to a specific transit system are governed by the characteristics of transit ridership. How important is peak-period ridership? Is there significant variation in the trip length distribution of transit ridership and in the demand elasticities by trip length? Although the choice of a fare structure involves trading off the ease of administration and convenience against the equity and revenue-generation potential, some generalizations can be tentatively advanced.

The size of the system will affect the choice of fare structure. Smaller systems without serious peak travel problems and without major differences in fare elasticities by trip distance should opt for flat fare systems. Under those conditions, the gains in revenue and equity are simply not worth the extra cost and inconvenience of distance-based fares. Distance-based fare structures are appropriate for transit systems with passenger trip lengths of five or more miles.

However, in larger systems -- such as Los Angeles, Oakland, and San Diego -- where peak-period travel is important and fare elasticities vary by trip length, distance-based and time-of-day fare structures are probably superior to flat fares in terms of equity and revenue generation. Whether the advantages in equity and revenue generation are worth the increased administrative costs can only be determined by analyzing passenger travel and operating costs.

With an understanding of these trade-offs, as well as the problems with the current fare structure, management should identify four or five fare structures that could be implemented. Those structures must be politically acceptable and regionally applicable options. The evaluation of such options will occur in Step 5.

Selecting Fare Collection Methods

There is an intimate relationship between decisions regarding fare levels, fare structure, and fare collection method, with the latter varying from simple cash fareboxes on surface vehicles to sophisticated automatic fare collection systems in rail systems. The fare collection equipment must be able to handle the coins and dollar bills used for paying the cash fares for the fare structures under review. The growth of sophisticated automatic fare collection machines has responded to the implementation of more complex fare structures combining zone and distance-based fares with time-of-day fare structures.

The objective of a fare collection system is to collect the exact fare while minimizing costs and detrimental effects on boarding times/vehicle speeds, driver/passenger interface, machine/passenger interface, and fraud and theft. That is, the fare collection system should be selected to minimize costs and passenger time and inconvenience.

The off-vehicle purchase of fare instruments and passenger self-service fare collection methods result in faster boardings. The nature of the driver/passenger interface depends on provisions in the labor relations agreements. In some systems, the driver handles the money, checks whether the correct fare is paid, and issues, collects, and inspects tickets and transfers. In more restricted labor agreements, drivers may only check that some coins and instruments are dropped in the farebox.

Fraud and theft are important problems to consider. Fraud can take the form of not paying the correct fare or paying in illegal coins (such as slugs, half dollar bills, foreign currency, etc.) Revenue losses from fraud usually amount to two to five percent of the cash fare revenue and are greater under zone- and distance-based fare structures because of the difficulties of supervising payment of the correct fare in the absence of machines or on-board checkers. A rule of thumb used in passenger self-service systems is that every rider should be checked every 40 to 50 rides to keep fraud at tolerable levels.

Theft can take place at several steps in the coin collection process. The greater the number of coin handling operations, the greater the probability of theft. Ticket-issuing machines are very sensitive to theft because they interface with riders, coin collecting staff, and maintenance personnel. To reduce problems of theft and fraud, prepayment instruments such as tickets and passes are being advocated. But even in those instances, there is the need for precaution by numbering the tickets and passes to check those issued against receipts.

The fare collection system can provide data on passenger movements, a feature significant in view of UMTA's Section 15 reporting requirements. Some of the sophisticated fare collection systems in place -- with their magnetic features, microprocessors, and computers -- can satisfy some of the requirements of management information system reports.

Selecting Fare Prepayment Plans

If the new fare plan will include prepaid fare instruments, how does a transit agency determine which fare prepayment plans to use and what restrictions

should be placed on their usage? The general approach has been to survey users and ask them what type of plan they would like. Unfortunately, people do not always react the way they say they will.

The first task in selecting the appropriate fare prepayment plan is to identify the target group the transit manager is most interested in reaching. Usually, this group shows a high potential for new or increased ridership. Many operators, however, simply want to provide some groups with a convenient, yet cost-effective alternative to cash payment. The target group may be identified either by trip purpose or client group (commuter, shopper, elderly, youth) or by the specific transit services they use (off-peak, CBD, or park-and-ride service).

Commuters usually choose their payment method on cost considerations alone. Their ability to predict the number of rides they will make enables them to select the most economical payment method. In addition, except for low-income riders, commuters are usually able to handle a lump-sum payment in advance. Thus, long-term or large-quantity plans -- such as annual or monthly passes, or 40-trip ticket books -- are appropriate for commuters. A variation of the monthly pass attracting considerable attention is the monthly commuter pass, which, by restricting its use to peak hours only, limits the usual revenue loss experienced in pass programs. Monthly permits are also appropriate and can preserve more peak-period revenues. However, in cities where a large proportion of the commuters are low-income riders, short-term plans (such as 10-trip ticket books and weekly passes) should also be offered because of the difficulties experienced by many low-income riders in financing the front-end costs of long-term plans.

Day passes and tickets, usually with off-peak-only restrictions, are most appropriate for shoppers. Tokens and punch cards are less useful than tickets, but may be used to encourage transit use for shopping. In general, small-quantity plans should be used and marked for off-peak use only.

College communities seem to have been first in experimenting with annual passes and other long-term fare prepayment methods. In one university community, high parking rates and an annual bus pass have encouraged many non-captive riders to use the bus system. As a general rule, students should be offered plans similar to those used during off-peak hours.

Fare prepayment programs designed for the transit-dependent should emphasize low cost. Low-quantity tickets can be provided since the front-end cost

is usually a problem. It may be found that, because the transit-dependent use transit frequently, passes or permits are most appropriate. Day passes may prove successful for low-income transit users.

Once a transit manager has identified a set of alternative plans that would be appropriate for the target group under consideration, it is important to select the plan that not only fits with other plans in operation, but also minimizes operating costs. Monthly and weekly passes, for example, may be appropriate for the same group, but their costs are significantly different. Consequently, knowing how much more (or less) it will cost each month to produce and sell one type of fare prepayment plan over another would be useful for planning purposes.

Attention must also be given to balancing the combination of plans offered. In some cases, fare prepayment plans can duplicate one another and lead to higher than necessary administrative costs. For most transit systems, two or three basic fare prepayment options will cover the range of consumer needs if the plans are properly priced relative to one another. A program with too many plans may prove difficult to administer and confusing to the public.

The possible combinations of fare prepayment plans are endless, and no one set or combination can be recommended for general use. However, the analysis of recent experience with transit fare prepayment does suggest that plans should be offered to cover both the frequent and infrequent ridership markets. Specifically, the following guidelines for establishing a balanced set of fare prepayment plans are recommended:

- A relatively low-priced, short-duration option should be made available to meet the needs of low-income people, the transit-dependent, and occasional riders. Day passes or 10-trip ticket books may be appropriate. Punch cards should be probably avoided because of their adverse effects on dwell time.

- Weekly or monthly passes or permits should be provided for frequent riders, complemented by a multiple-trip format, such as strip tickets or ticket books.

- The plans and their respective discount rates should be determined by their ability to encourage greater transit usage at minimum cost to the system. The plans should stimulate off-peak transit use where the marginal cost of providing increased service is low. Low-quantity plans should not be discounted, whereas long-duration plans that encourage regular transit usage, such as monthly passes, can be slightly discounted. Caution should be taken not to extend to peak-period users other than nominal discounts because of their inelastic demand response and because of the higher cost of peak-period service.

Selecting Promotional Fare Programs

The design of promotional fares programs has to be approached with care because of the danger of revenue losses. Successful promotional fare programs have certain elements in common, namely:

- they are of short duration,
- they are targeted on new riders,
- they use excess capacity during off-peak hours, and
- they include continuous monitoring and evaluation activities.

Most promotional fare programs have a short duration period. The duration period should be long enough to enable the rider to assess the quality of the service and to feel comfortable with its use. A one- or two-week period is probably enough for most programs. The short duration is designed to minimize revenue losses.

Promotional fare programs must be targeted to new riders and not to frequent riders. Obviously, giving fare discounts to persons who would ride transit anyway is self-defeating. Promotional fare programs -- such as "Fare-Free Days" or "Bargain Fare Day" -- that fail to target promotions to non-transit riders should be avoided.

Some promotional fare policies promote travel during periods of excess capacity, such as on weekends and during off-peak shopping hours. These programs, if properly designed by avoiding frequent riders, can be cost-effective. Downtown businesses should be encouraged to help offset the cost of implementing promotional fare programs.

Few promotional fare programs are monitored closely for their short-term and long-term ridership and revenue impacts. Yet the need for continuous evaluation and monitoring of these programs is evident. Successful programs are those that lead to the highest number of new transit trips per dollar of revenue foregone in the promotion.

STEP 4: EVALUATE FARE OPTIONS

The initial step in evaluating each of the fare options identified above is to forecast changes in the existing conditions, assuming fares will remain

constant. Cost, ridership, and revenues will change over the period under investigation even if fares do not. Labor and fuel costs are rising, and ridership may grow simply because the economy and the population are growing. These forecasts will provide management and staff with the new base conditions for comparing each fare plan.

Look at each of the fare plans selected in the preceding section and identify each of the fare paying groups for which data must be provided. The total number of unique fare paying groups that can be combined to meet any of the market groups under investigation will become the level of analysis. For example, assume that five fare structures are being considered by management: a revised flat fare, two time-of-day fare structures, and two zone fare structures. For each fare structure, define the fare paying categories, such as:

- cash fare patrons, by zone and/or time-of-day,
- prepayment patrons (tickets and monthly pass riders),
- express service,
- elderly and handicapped,
- etc.

Each of the ridership-based evaluation criteria for each fare structure option must be evaluated at this disaggregate level.[1] Consequently, ridership, costs, and fare elasticities of demand must be available for each group. Disaggregate ridership levels should be easy to obtain from existing data collection sources and recent on-board surveys. Costs for each group should be obtained using the system's cost allocation model. Elasticities should be computed from past fare changes. If disaggregate elasticities are not available, estimates (default values) can be obtained from the elasticity table provided in Table 6-2.

With the data available for each fare option, the staff must now select fare levels for each fare option so that the evaluation criteria established in Step 2 are met. Although this is the generally accepted approach to pricing, it is not theoretically correct. If the purpose of the transit agency is to maximize the benefits provided to transit users while meeting the budget requirements, management should select fare levels so that the mark-up, or percent deviation of fares from marginal cost, is inversely proportional to the fare elasticities.

[1]In the example presented in the appendix to this manual, there are 40 unique fare-paying groups.

Table 6-2: FARE ELASTICITIES BY MARKET COMPONENTS IN A HYPOTHETICAL SYSTEM

Assuming a -0.35 Aggregate Fare Elasticity

Transit Rider Submarkets

Fare Structure Element	Average	Commuters	Shoppers	Elderly	Students	Low Income	Choice	Captive
CASH FARES	-0.35	-0.18	-0.45	-0.44	-0.25	-0.25	-0.46	-0.22
Prepaid Plans								
• Tickets	-0.33	-0.17	-0.43	-0.42	-0.33	-0.24	-0.43	-0.21
• Passes	-0.26	-0.14	N.A.	-0.33	-0.27	-0.19	-0.34	-0.17
Distance-Based								
• Short Distance	-0.50	-0.25	-0.62	-0.58	-0.55	-0.37	-0.66	-0.32
• Long Distance	-0.23	-0.12	-0.30	-0.25	-0.23	-0.17	-0.30	-0.14
Time Period								
• Peak	-0.21	-0.16	-0.25	-0.25	-0.20	-0.15	-0.27	-0.13
• Off-Peak	-0.48	-0.24	-0.62	-0.55	-0.52	-0.35	-0.63	-0.30
Special Discounts								
• Elderly & Handicapped	-0.44	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
• Short-Term for General Public	-0.53	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Express Service	-0.16	-0.12	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note: Many cells correspond to inapplicable or incompatible elements, as may be the case. To develop elasticities specific to a given system, divide each cell by -0.35 and then multiply by that system's aggregate fare elasticity.

Source: Armando M. Lago and Patrick D. Mayworm. "Transit Fare Elasticities by Fare Structure Elements and Ridership Submarkets." Transit Journal, Spring 1981, p. 12.

That is, the mark-up should be smaller in more elastic markets, such as for off-peak travelers or for short-distance trips, than in inelastic markets.

In practice, however, this pricing rule runs into problems due to the inability of present-day costing methodologies to properly estimate marginal costs for different transit services. In addition, political realities sometimes make it difficult to implement pure economic solutions to fare design problems. For that reason, this manual follows the more conventional approach of selecting fares based solely on fare elasticity of demand.

To compare fare plan options, the fare levels selected for each should meet the most important evaluation criterion. With the most important criterion met, each fare plan option can then be evaluated according to how well it meets the remaining criteria.

Suppose, for example, that the revenue target for the new fare structure is \$33,000 per weekday, up from \$28,000. If the existing flat fare of \$0.65 were changed to meet this revenue target under four fare structure alternatives, the figures presented in Table 6-3 would result. The new revenue levels for each fare plan option meet the revenue target, plus or minus one percent.

Using these fare levels, the staff's next step is to evaluate each fare option with respect to each of the remaining evaluation criteria. How closely has the ridership target been met? Are there still large differences in the revenue/cost ratios for each ridership group? Do the new fare structure proposals meet the operational and social needs of the transit system and community? Table 6-4 summarizes the evaluation results for the five fare plans used in the above example.

Each fare option is evaluated according to the criteria established in Step 2. In this example, the following five evaluation criteria were chosen:

- daily revenue production,
- daily ridership level,
- equity considerations based on the revenue/cost ratio,
- operational feasibility, and
- socioeconomic in terms of encouraging CBD travel and development.

The forecasted base conditions are shown in the first row of the table, followed by the target conditions set for each criterion. The evaluation results for the five fare options used in this example are presented at the bottom

Table 6-3: ALTERNATIVE FARE OPTIONS EVALUATED

Fare Paying Category	Existing Conditions			OPTION B: 4-Zone Fare Structure				OPTION C: 3-Zone Fare Structure			OPTION D: Peak/Off Peak With Existing Off-Peak Fares		OPTION E: Peak/Off-Peak With Reduced Off-Peak Fares	
	Weekday Ridership	Fare	Optimal Flat Fare	CBD Zone 1	Zone 2	Zone 3	Zone 4	Central City Zone 1	Zone 2	Zone 3	Peak	Off-Peak	Peak	Off-Peak
Cash Fare	24,255	$ 0.65	$ 0.80	$ 0.30	$ 0.65	$ 1.3	$ 1.75	$ 0.65	$ 1.00	$ 1.50	$ 0.85	$ 0.65	$ 0.85	$ 0.35
Tickets	4,560	0.65	0.80	0.30	0.65	1.30	1.75	0.65	1.00	1.50	0.85	0.65	0.85	0.35
Monthly Pass	8,615	26.00	32.00	26.00	26.00	52.00	70.00	26.00	40.00	60.00	34.00	26.00	34.50	14.00
Express	1,895	1.00	1.25	N.A.	N.A.	1.75	2.00	N.A.	1.25	1.75	1.25	N.A.	1.50	N.A.
Elderly and Handicapped	10,675	0.30	0.40	0.15	0.30	0.65	0.85	0.30	0.50	0.75	0.60	0.30	0.85	0.35

Table 6-4: SUMMARY RESULTS OF FARE ANALYSIS

	EVALUATION CRITERIA						
	Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%)			Operational Feasibility	Socioeconomic Encouragement of CBD Travel and Development
			Avg.	Min.	Max.		
Existing Fare Level	$28,145	50,000	50	18	137	Excellent	Poor
Target Values	$33,000	47,500	55	30	100	Good	Good
Acceptable Values	$31,680	46,000	53	25	120	Poor	
Fare Structure Options							
OPTION A: Flat Fare Structure	$32,194	45,696	55	24	149	Excellent	Poor
OPTION B: Four-Zone Fare Structure	$31,774	56,940	54	45	98	Very Poor	Excellent
OPTION C: Three-Zone Fare Structure	$32,295	47,945	55	40	131	Poor	Good
OPTION D: Peak/Off-Peak Fare Structure With Existing Off-Peak Fares	$32,885	47,863	56	24	146	Good	Poor
OPTION E: Peak/Off-Peak Fare Structure With Reduced Off-Peak Fares	$32,114	51,149	54	25	120	Good	Good

of Table 6-4. Note that Options C and E meet all five criteria. A more detailed example of how to identify and evaluate fare structure options is presented in the appendix to this manual.

STEP 5: RECOMMEND FARE PLAN TO TRANSIT BOARD

Although the process outlined in this manual will lead to a staff-recommended fare plan, it should be clear that, with just minor changes to the evaluation criteria established in Step 2, a different fare plan could have resulted. This has strengthened the movement toward fares being political policy decisions derived from public attitudes, general economic and fiscal conditions, and the influence of vested interests. For these decisions to remain in the hands of transit management, the transit board must be involved throughout the process described here. Thus, the reasons used by management and staff for selecting a particular fare plan must, in part, be generated by the group of people who will eventually make the final decision about which fare plan to adopt.

In obtaining board approval for implementation of a particular fare plan, management must clearly present the advantages and disadvantages of the recommended plan. In addition, alternative fare plans must also be discussed. If an alternative is only slightly inferior to the recommended plan, but may be politically easier to implement, then the board may opt for the alternative. The job of the transit board, after all, is to make political decisions that are in the best interest of the transit system and its patrons. These decisions are based on operational facts and political insights. The results of the process outlined in this manual should provide policy-makers with the facts.

7

IMPLEMENTING AND EVALUATING FARE CHANGE

Task 1		Task 2		Task 3		Task 4		Task 5
Prepare Organization for Fare Planning	→	Gather and Manage Data	→	Review Fare Plan Options	→	Select Appropriate Fare Plan	→	Implement and Evaluate Fare Change

7

IMPLEMENTING AND EVALUATING THE FARE CHANGE (TASK 5)

Once an appropriate fare plan has been selected, three steps remain before the actual fare change can go into effect:

1. Citizen involvement activities must be undertaken.
2. An on-going fare monitoring process should be established.
3. Any logistical activities involved in changing the fare structure must be completed.

Citizen involvement includes notifying the affected population of the proposed change, conducting formal public hearings on the issue, and responding to community comments on the change. Monitoring and evaluating of the effect of the fare change on ridership is accomplished by instituting an on-going data collection and data management process (described in Chapter 4, Task 2). Finally, activities aimed at the smooth transition from one fare level and structure to another must be carried out. These logistical activities include public advertising, driver training, and dealing with any changes in the mechanics of fare collection.

INVOLVING CITIZENS IN THE FARE PLANNING PROCESS

A major consideration in implementing a fare change is involving citizens in the process. Most transit agencies have an approved plan for how and when

citizens will be involved in transportation planning activities.[1] Among other things, such plans cover:

- Key issues and decision points where citizen involvement will be sought.
- Mechanisms for involving citizens and the timing of such efforts, including:
  -- notifying the public, and
  -- disseminating information materials.
- Procedures for considering and responding to public comments.

Notifying the Public

Federal laws authorizing UMTA operating and capital grant programs require the applicant to certify adequate public notice of projects affecting the community.[2] The public should be notified well in advance of the fare change so it has a chance to respond. Background information should be made available on why the fare policy is being changed. In particular, public information materials should address fare equity for different user groups (e.g., suburban commuters vs. inner city residents) to forestall potential charges that the fare change is unfair. It is also important to keep public information materials as non-technical as possible. In addition, all public information documents or announcements should identify someone to contact for further information.

Possible mechanisms for informing the public of a fare change include:

- Public service announcements on radio or television.
- Newspapers.
- Announcements on public vehicles and at transit stops.
- Community bulletin boards.
- Flyers.

Involving the Public

Once the public has been informed about the proposed change in fare policy, a number of mechanisms can be used to solicit public input. The most common is

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[1]The DOT Guidelines on Citizen Participation in Local Transportation Planning, issued in the Federal Register on January 19, 1981, require a plan for citizen participation.

[2]Public Law 88-365, as amended.

the public hearing. In fact, the law authorizing capital and operating assistance through UMTA programs requires that recipients hold public hearings concerning projects that will substantially affect the community.[1] And an UMTA regulation implements that statutory requirement.[2]

Another formal mechanism to involve the public might be setting up an ad hoc or on-going citizen advisory group on fare planning. Other, less formal, involvement mechanisms include:

- Community or neighborhood association meetings.
- Town meetings.
- Telephone hotlines.
- Citizen advocates.

Regardless of the mechanisms, any plans for public participation should consider times and places convenient and accessible to the public.

Considering Public Comments

Citizen comments on the proposed fare change should be tabulated and summarized for review by the transit agency staff, management, and board. Those comments should be considered and responded to before a final decision is made regarding implementation. Such comments provide a valuable tool for decision-making in that they often predict user response to the proposed change.

ESTABLISHING THE FARE EVALUATION PROCESS

As stressed earlier, the fare planning process is a continuing effort, not one performed intermittently or when a crisis arises. Fare policies should be reviewed at least annually. To make the best decisions, now and in the future, it is essential to have first-hand, system-specific information on the impacts of the proposed fare change on ridership, revenue, and cost. This data gathering process should be designed and in place before the fare change is implemented.

Once implemented, the fare change should be monitored and evaluated in terms of how well it meets the goals set by the transit operator as part of the

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[1]Public Law 88-365, as amended.

[2]49 CFR 635.

planning process. Those goals can include: (1) ridership generation, (2) revenue generation, (3) fare equity, (4) operational simplicity, and (5) social and environmental considerations.

Thus, the purpose of evaluating fare change impacts on ridership is to:

1. Gain insights to the effect on ridership and revenue.
2. Analyze the effect on fare equity.
3. Determine the effect on operational simplicity.
4. Measure the effect on socioeconomic and environmental goals.

As explained in the following sections, the appropriate level of evaluation will vary depending on the type of fare change. If the change is a simple increase in fare level, then data may be collected and analyzed on an aggregate basis across all time frames and for all users. If, however, the change involves the fare structure or fare collection procedures, data must be collected and analyzed in a disaggregate manner that allows the transit agency to make an in-depth evaluation.

Managing Fare Monitoring Data

Four basic types of data can be used in the fare impact evaluation:

1. System operational data (ridership, fare level, service, cost).
2. User survey data.
3. Information on administrative costs and procedures.
4. Information on fare collection costs and procedures.

These data will have been collected and analyzed during the fare planning process described in Chapter 4 (Task 2). They are used as descriptors of the "before" situation and should include at least the six-month period prior to the fare change. To perform the evaluation, similar data for the "after" period should be collected. The "after" period begins as soon as the fare change has been made. Data should be collected from that time, even though the effect of the fare change will not have stabilized for at least 5-9 months. Data collection should continue for at least six months after the fare change effect has stabilized. When comparing "before" and "after" data, extraneous influences on ridership and revenue (for example, seasonal variations, bus miles supplied, central city employment, gas prices, etc.) must be minimized. To the extent

possible, "before" data should be examined for the same months as "after" data. (Some methods of calculating elasticities do control for extraneous effects; see Chapter 4.)

A primary purpose of the fare impact evaluation is to gain insights to the sensitivity of users (and specific user subgroups) to the fare change so that, when the transit agency makes future fare decisions, the benefits of lessons learned can be taken into account. A good measure of user sensitivity is fare elasticities (see Chapter 4 for a full review of fare elasticities). To the extent needed, such elasticities should be developed for disaggregate market groups.

If the proposed change involves the fare structure, then ridership, revenue, and cost data should be disaggregated for:

1. Time of Day:
   - peak
   - off-peak

2. Day of Week:
   - weekday
   - weekend

3. Payment Method:
   - cash
   - pass
   - ticket/token

4. Route Type:
   - CBD
   - radial
   - suburban

5. User Characteristics:
   - adult
   - student
   - senior citizens
   - disabled
   - income level

User surveys may also be helpful to ascertain how and why riders are reacting to the fare change. This method is particularly useful in evaluating the effect of new fare structures (e.g., distance-based fares where trip distances can only be gathered through surveys) or new fare collection methods. Data on changes in administrative costs and procedures resulting from the fare change and data on changes in fare collection procedures and costs should also be kept.

Analyzing the Effect of the Fare Change on Ridership and Revenue

Because rider response to fare changes is inelastic, increases in fare levels will reduce ridership and increase revenue. Conversely, decreases in fare levels will increase ridership and decrease revenues. When making a change in fare level (even if only for one user group), it is extremely important to monitor rider response. The relative sensitivity of riders to fare increases or decreases is often measured using fare elasticities.

The first step is to collect and analyze raw data on ridership and revenue both "before" and "after" the fare change. This should be done first on an aggregate system level and then disaggregated by user group. (It may be necessary to employ some user survey data to disaggregate ridership and revenue totals.) A second step would be to supplement this review with user survey data to help explain the rider response.

Analyzing the Effect of the Fare Change on Fare Equity

Fare equity is defined as how equitable the fare structure and fare level are to the various groups that ride the system: Do user groups pay comparable amounts for the same trip distance and service quality? Fare equity is often defined in terms of the relative fare paid per passenger mile for various route types and user groups. Another way fare equity is measured is as the ratio of fare paid per passenger mile divided by the cost incurred to provide a mile of service.

Much of the information needed to evaluate fare equity will come from a user survey using the fare level, trip distances, and service levels on various routes and the resulting cost per passenger mile. Once these data are available, a judgement must still be made as to what is "equitable". This is fairly subjective especially with regard to how much more users should pay for premium or peak hour service.

Analyzing the Effect of Fare Change on Operational Simplicity

Operational simplicity includes how convenient it is for passengers to pay and the system to collect fares. It also includes how easy it is for the system to control for fraud and fare evasion.

The first, user convenience, is fairly subjective. However, some assessment of the convenience and effect of the fare collection procedures on users can be ascertained from the user survey.

The second consideration, the cost of fare collection, should also be monitored when making a fare change since the introduction of a new fare structure may involve a change in fare collection procedures. Changing to or from a more complex fare structure could involve an increase or decrease in administrative costs, driver training costs, marketing costs, and fare collection costs. (The increased costs of new fare policies are often the result of new, more complicated and cumbersome fare collection procedures.) When planning for the fare change, administration and fare collection functions should be identified which will change as the result of the revision to fare policy. These may include items such as record keeping functions, administering a transfer program, and other special fare collection procedures. Once the fare change is made, data should be collected on how these functions change and the resulting increase or decrease in costs.

A final evaluation issue to consider when implementing a fare change is whether the new fare structure or level results in more or less fare evasion. This is fairly difficult to measure and analyze, but in general, the more complicated the fare structure, the greater the possibility of fare evasion. One of the most common responses to fare evasion worries is to impose more rigorous (and complex) fare collection procedures. However, more rigorous procedures will usually cost more money. It may be necessary to make tradeoffs between additional fare collection costs versus what can be saved through fare evasion measures.

Analyzing the Effect of the Fare Change on Socioeconomic and Environmental Goals

The final category of goals which must be considered are socioeconomic and environmental goals such as increasing the mobility of special user groups (elderly and disabled persons), meeting air pollution or auto congestion goals and fostering economic development. Achievement of this type of goal is extremely hard to measure. However, some attempts to consider them in a quantitative or even qualitative fashion should be made.

Increasing the mobility of special user groups is subjective but you can state that lower fares or special programs increase ridership. Progress toward meeting environmental goals may be measured using the results of the user survey

to estimate the amount of persons switching to transit and their trip length and then project the total auto emissions not released into the environment as a result of decreased auto usage. Reduction in traffic congestion can be measured in a similar way. Fostering downtown development may be more difficult to measure since the downtown effects are sometimes partially offset by development effects somewhere else in the metropolitan area.

DEALING WITH THE LOGISTICS OF FARE IMPLEMENTATION

Changes to fare level, fare structure, and fare collection methodologies bring with them a number of logistical problems which must be addressed before the change can be implemented. Riders must be notified of fare change when the change goes into effect. Depending upon the extent of the change, this may require some educational and media promotion, particularly where a change in fare structure is involved. Riders must be able to understand the new fare structure and promotional materials must present this information in a clear and concise manner.

Again, depending upon the extent of the changes, drivers may have to be trained in how to calculate and collect fares and the actual fare collection mechanism and procedures must be designed.

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APPENDIX

APPENDIX

AN EXAMPLE OF SELECTING FARE OPTIONS

INTRODUCTION

The process of selecting an appropriate fare plan as outlined in this manual can be complex. To illustrate how one transit system might approach this problem, the authors have prepared a case study example. This example takes the reader through the five steps described in Chapter 6, beginning with an evaluation of the existing fare policy to the recommendation of a fare plan.

BACKGROUND

The site for this case study is the hypothetical Midwestern city, Pricing, Missouri. Pricing is an agro-business and industry-based city situated on the Mississippi. Pricing has a strong center city, where two universities, the county government, and major financial institutions are located. In 1980, Pricing and the surrounding urbanized area had 700,000 inhabitants.

Since 1970, public transportation in Pricing has been provided by USA Transit. USA Transit replaced an ailing private company when voters created a regional transit district with taxing authority. During the past decade, the ridership decline has been reversed and USA Transit now carries over 15 million passengers each year. Some of the statistics on USA Transit's operations are shown in Table A-1.

Table A-1

USA TRANSIT FACTS

• Service Area Population:	700,000 people
• Fleet Size:	240 buses
• Employees:	450 people
• Routes:	66 individual routes
• Annual Bus Mileage:	Over 6 million
• Average Weekday Ridership:	50,000 people
• Average Rider Trip Length:	4 miles

STEP 1: EVALUATE EXISTING FARE POLICIES

USA Transit operates a flat fare structure throughout the service area. The existing fare levels are provided in Table A-2, along with average weekday ridership and revenue statistics. Free transfers are allowed at the present time.

Table A-2

RIDERSHIP AND REVENUES BY FARE PAYING CATEGORY

Fare Paying Category	Fare Level	Average Weekday Ridership	Revenue
Cash Fare	$ 0.65	24,255	$15,766
10-Trip Ticket Book	6.50	4,560	2,964
Monthly Pass	26.00	8,615	4,318
Express Service	1.00	1,895	1,895
Elderly & Handicapped	0.30	10,675	3,202
		50,000	$28,145

Using data from recent on-board surveys and operating statistics, USA Transit was able to construct a ridership distribution table separating ridership in each fare paying category by peak and off-peak periods and by trip length. Since over 70 percent of passenger traffic is radial to the center city, for simplicity all travel is assumed to have an origin or destination in the center city. Table A-3 presents this distribution.

Table A-3: DISTRIBUTION OF WEEKDAY RIDERSHIP BY FARE PAYING CATEGORY, TIME OF DAY, AND TRIP DISTANCE

Fare Paying Category	A.M. & P.M. PEAK HOURS					OFF-PEAK HOURS					TOTAL
	City of Pricing		Suburbs		SUB-TOTAL	City of Pricing		Suburbs		SUB-TOTAL	
	CBD (1 Mile)	Zone 2 (2.5 Miles)	Zone 3 (5.5 Miles)	Zone 4 (10 Miles)		CBD	Zone 2	Zone 3	Zone 4		
Cash Fare	7,130	6,415	1,430	1,425	16,400	3,570	2,855	1,000	430	7,855	24,255
10-Trip Ticket Book	1,140	750	570	390	2,850	855	425	280	150	1,710	4,560
Monthly Pass	3,440	1,720	860	430	6,450	920	580	350	315	2,165	8,615
Express Service	0	0	1,135	760	1,895	0	0	0	0	0	1,895
Elderly & Handicapped	1,068	715	535	352	2,670	3,200	2,135	1,600	1,070	8,005	10,675
TOTAL	12,778	9,600	4,530	3,357	30,265	8,545	5,995	3,230	1,965	19,735	50,000

USA Transit is conducting this fare review because an operating revenue shortfall is forecasted for the 1984 fiscal year. Operating costs are expected to grow at a 4.9 percent rate and Federal operating assistance will be cut by 24 percent. Ridership will not grow, but other outside subsidies are expected to increase. These increases, however, will not offset the rise in costs and reduction in Federal assistance.

USA Transit currently obtains 50 percent of its operating expenses from the farebox. Table A-4 presents the sources of all revenues covering operations.

Table A-4

1983 OPERATING REVENUE AND SUBSIDIES

Operating Farebox Revenue		$ 7,965,000
Operating Subsidies		
Federal	$4,301,100	
State	3,114,315	
Local	366,390	
Total		$ 7,781,805
Other Revenues		183,195
Total Revenues		$15,930,000
Operating Expenses		$15,930,000
Surplus (Deficit)		-0-

USA Transit's buses each have registering fareboxes. Fare collection costs are estimated to be $450,000 per year and there is very little fraud or theft. The revenue collection offices have had no problem with the tickets clogging fareboxes. From a data collection standpoint, however, management would like to obtain more reliable information on monthly pass usage.

Finally, USA Transit collected information on the costs of operating all services. Although marginal costs could not be computed, fully allocated costs by trip length and time period were obtained using the system's cost allocation formula. A summary of some of the statistics obtained is presented in Tables A-5 and A-6.

Table A-5

COSTS AND REVENUES BY TRIP LENGTH

Costs and Revenues	CBD	Zone 2	Zone 3	Zone 4	Total
Passenger Trips	21,323	15,595	7,760	5,322	50,000
Avg. Trip Length (miles)	1.0	2.5	5.5	10.0	3.12
Passenger Miles	21,323	38,988	42,680	53,220	156,211
Revenue	$11,718	$ 8,797	$ 4,514	$ 3,116	$28,145
Revenue/Trip	0.55	0.56	0.58	0.59	0.56
Revenue/Passenger Mile	0.55	0.23	0.11	0.06	0.18
Cost	$8,540	$15,112	$15,442	$17,195	$56,289
Cost/Trip	0.40	0.97	1.99	3.23	1.13
Cost/Passenger Mile	0.40	0.39	0.36	0.32	0.36
Revenue/Cost Ratio (%)	137%	58%	29%	18%	50%

Table A-6

COSTS AND REVENUES BY TIME PERIOD

Costs and Revenues	Peak	Off-Peak	Total
Passenger/Trips	30,265	19,735	50,000
Avg. Trip Length (miles)	3.15	3.09	3.12
Passenger Miles	95,263	60,948	156,211
Revenue	$18,441	$ 9,704	$28,145
Revenue/Trip	0.61	0.49	0.56
Revenue/Passenger Mile	0.19	0.16	0.18
Cost	$39,345	$16,944	$56,289
Cost/Trip	1.30	0.86	1.13
Cost/Passenger Mile	0.41	0.28	0.30
Revenue/Cost Ratio (%)	47%	57%	50%

STEP 2: ESTABLISH EVALUATION CRITERIA FOR ANALYZING OPTIONS

USA Transit management knew what they wanted the fare change to accomplish. First, they had done all they could to reduce operating costs and to increase other operating subsidies. Local subsidies would increase 23 percent; state aid would jump 11 percent. Nevertheless, a major revenue shortfall was predicted. Table A-7 presents the projected costs and revenues for FY84.

Table A-7

PROJECTED COSTS AND REVENUES FOR FY84

Operating Farebox Revenue		$ 9,338,570
Operating Subsidies		
Federal	$3,277,000	
State	3,450,000	
Local	450,000	
Total		$ 7,177,000
Other Revenues		195,000
Total Revenues		$16,710,570
Operating Expenses		$16,710,570
Surplus (Deficit)		-0-

Notice that, in order to balance the budget, USA Transit needed to raise more than $1.3 million in extra farebox revenues during the new fiscal year. This would have been a 17 percent increase. The revenue target for fare change, therefore, was set at $9,338,570 per year or $33,000 per weekday.

Although management had to accept a high revenue target, they were determined to minimize the negative ridership impact of the fare increase. At first, some board members wanted to select specific market groups that could not be negatively affected by the fare change. Following considerable debate, the policy committee stated that total system ridership could not drop by more than five percent as a result of the fare change.

Management also was interested in improving the equity of the fare structure. Under the present flat fare structure, over ten percent of daily passengers are traveling over 10 miles and paying only 65 cents per trip. As shown in Table A-5, these passengers are paying only six cents per mile, while CBD riders are paying an average 55 cents per mile. Although the costs per mile are slightly lower for long-distance trips, riders traveling the longest distances are only paying 18-30 percent of what it costs to provide those trips. Short-distance riders, on the other hand, are paying as much as 137 percent of the cost of the service. A clear goal of the new fare structure would be to reduce these inequities.

Finally, the revenue collection officers did not want to see a change in the fare structure if such a change would lead to higher operating costs and fraud. A 25 percent increase in collection costs (including driver time spent enforcing the new fare structure) was the maximum management would allow.

A summary of the evaluation criteria that will be used to evaluate each of the fare options is presented in Table A-8. Notice that, in addition to the target values set by management, acceptable ranges are also provided. Since it is difficult to achieve all target values with one fare plan, the minimum and maximum values define a range within which a fare option is acceptable.

Table A-8

EVALUATION CRITERIA

Evaluation Criteria	Objective	Target Value	Minimum Allowable	Maximum Allowable
Revenue Production	Maximize Revenues	$33,000/ day	$31,680/ day	None
Ridership Loss	Minimize Ridership Loss	2,500 trips/ day	None	4,000 trips/ day
Fare Equity	Equalize Revenue/ Cost Ratio	55%	25%	120%
Operational Feasbility	Minimize Operational Complexity	Specific Values Are Not Given		
Fare Collection Costs	Minimize Increase in Fare Collection Costs	$112,550/ year	None	$150,000/ year

STEP 3: SELECT FARE OPTIONS

The analysis of the current fare structure identified two major deficiencies. First, not enough revenue is generated from the farebox. As a percentage of operating costs, farebox revenues have been declining over the past decade.

The second major deficiency concerns the distribution of the revenue-to-cost ratio among different ridership groups. Over 40 percent of the riders on USA Transit travel on average only one mile and pay over 130 percent of what it costs to serve those trips. Long-distance riders, on the other hand, pay less than 20 percent of what it costs to provide service to the outer suburbs.

As a result of this analysis, USA Transit management agreed to explore alternatives to the present flat fare structure with the goal of increasing revenues and minimizing the inequities. After reviewing the regional applicability and operational feasibility of numerous fare structure designs, management identified five options to test:

- flat fare structure with higher fares,
- four-zone fare structure with a reduced CBD fare,
- three-zone fare structure with the center zone incorporating all of the city of Pricing, holding the price for the first zone at 65 cents,
- peak/off-peak fare structure with off-peak fare held at 65 cents, and
- peak/off-peak fare structure with reduced off-peak fare.

From our operational viewpoint, it appeared that each of the five options was feasible at a minimal cost to the system. Boundaries for zones were easily determined, as were the peak-period hours. The drivers' union had concerns about enforcement, but did not immediately reject the options.

STEP 4: EVALUATE FARE OPTIONS

The first step in evaluating the fare options is to forecast changes in the base conditions, assuming the fares remain constant. Cost, for example, will increase by 4.9 percent, as already indicated. Ridership would normally increase as well due to secular trends in ridership levels. However, because

of Pricing's continued low growth and the low cost of gasoline, ridership is not expected to rise in 1984. If no changes are made to the USA Transit system in the next fiscal year, ridership will continue to be at 50,000 per weekday.

To evaluate the impact of fare changes on ridership and revenues, one more piece of information is needed: the fare elasticity of demand. Although an analysis of the impact of the last fare change was performed by the staff, the analysis did not look at individual ridership groups. Consequently, only an elasticity for the system as a whole was estimated. The systemwide fare elasticity is -0.40.

The fare elasticities for peak and off-peak periods and by trip length for each fare paying category were computed using guidelines presented in a 1980 fare change study.[1] These elasticities are shown below in Table A-9.

Table A-9

DISAGGREGATED FARE ELASTICITIES BY MARKET GROUP

Fare Paying Category	Peak Hours	Off-Peak Hours	CBD	Zone 2	Zone 3	Zone 4
Cash Fares	-0.24	-0.55	-0.57	-0.46	-0.35	-0.24
10-Trip Ticket Book	-0.22	-0.52	-0.54	-0.44	-0.33	-0.22
Monthly Pass	-0.18	-0.40	-0.42	-0.34	-0.26	-0.18
Express Service	-0.18	—	--	--	-0.19	-0.17
Elderly & Handicapped	-0.30	-0.69	-0.72	-0.58	-0.44	-0.30

In each of the fare options presented below, new ridership levels were computed using the arc elasticity formula:

$$\varepsilon = \frac{\log Q_2 - \log Q_1}{\log F_2 - \log F_1}$$

[1]Ecosometrics, Inc. Patronage Impacts of Changes in Transit Fares and Services. Prepared for the U.S. Department of Transportation, September 3, 1980.

where ε is the fare elasticity of demand for ridership and fare level changes from (Q_1, F_1) to (Q_2, F_2). By rearranging this formula, one can calculate the new ridership level (Q_2) based on the existing ridership level (Q_1), the old and new fares (F_1, F_2), and the fare elasticities provided in Table A-9. This formula is written:

$$Q_2 = Q_1 \left(\frac{F_2}{F_1} \right)$$

Note that the ratio of fares is raised to a power equal to the fare elasticity of demand. Thus, if current ridership is equal to 1,000 trips per day at a fare of 65 cents, the fare elasticity equals -0.35, and the new fare to be tested is 85 cents, then the new ridership level will be:

$$Q_2 = 1{,}000 \left(\frac{85}{65} \right)^{-0.35} = 910 \text{ trips/day}$$

Option A: Flat Fare Structure with Higher Fares

The objective of this option is to maintain the convenience and simplicity of the existing flat fare structure. The result of this fare policy is that each fare-paying category will pay proportionally more for transit service while meeting the farebox recovery criterion.

Several fare increases were tested. Under a flat fare scheme, the fare levels would have to rise by more than 20 percent to reach the minimum acceptable revenue recovery of $31,680 per weekday. However, even at fares of 75 cents, more than 2,500 passengers are lost. When there are different ridership categories with unique fare elasticities, flat fare structures are the least efficient means of generating additional passenger revenue.

The best flat fare increase is the one that meets the minimum revenue target. Cash fares, therefore, will have to increase to 80 cents, as shown in Table A-10. Over 4,000 trips will be lost and the equity of the fares paid by ridership group has deteriorated. Operationally, the system is unchanged and, consequently, no additional fare collection costs are expected.

Option B: Four-Zone Fare Structure with Reduced CBD Fares

An alternative method of raising farebox revenues is to charge riders in some proportion to the distance traveled. A distance-based fare structure is also designed to take advantage of the different elasticities of demand. Unfortunately, distance-based charges are difficult to operate and understand, and may lead to consumer fraud.

Three four-zone fare structures were tested in this option. In all three tests, the second zone charges were not changed from the current fare level, the CBD-zone fares were reduced, and the fares for the two outer zones were raised. All three options resulted in both increased revenue and ridership. This is possible because of the different elasticities. However, only the second and third tests met the revenue criterion.

By charging a fare according to distance, USA Transit hoped that the revenue-to-cost ratios would be closer together for each fare category. Although a distance-based fare structure does reduce the inequities of a flat fare structure, there remain significant differences in the revenue/cost ratios by trip length.

A four-zone fare structure is the most complex and expensive option under investigation in this fare study. Management estimates that the four-zone structure would cost between $150,000 and $200,000. These figures include driver time allocated to enforcing and explaining the fare structure, the increased cost of fare prepayment printing and distribution, and the higher cost of dollar bill collection.

As a result of this analysis, the management team identified the second test as the best set of fare levels for this fare option. The results of this analysis are shown in Table A-11. The minimum revenue production level is met and the new ridership levels exceed present levels. The fare collection costs are expected to increase by as much as $150,000. Operationally, however, this option is the most difficult to implement.

Option C: Three-Zone Fare Structure with Large Center Zone

The four-zone fare structure can be made less expensive if the first two zones are combined into one large zone incorporating the city of Pricing. This option has the advantage of not only reducing fare collection costs, but also of being less confusing and less difficult to operate than the four-zone option.

Table A-10

OPTION A: FLAT FARE STRUCTURE

New Fare Levels Tested

Fare Paying Category	New Fare Levels
Cash Fare	$0.80
Tickets	0.80
Monthly Pass	0.62
Express	1.25
Elderly & Handicapped	0.40

Evaluation Results

Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%)			Operational Feasibility	Annual Extra Fare Collection Costs
		Avg.	Min.	Max.		
$32,194	45,696	55	24	149	Excellent	0

Table A-11

OPTION B: FOUR ZONE FARE STRUCTURE WITH REDUCED CBD FARE

New Fare Levels Tested

Fare Paying Category	CBD	Zone 2	Zone 3	Zone 4
Cash Fare	$0.30	0.65	1.30	1.75
Tickets	0.30	0.65	1.30	1.75
Monthly Pass	0.50	0.50	1.25	1.60
Express	N.A.	N.A.	1.75	2.00
Elderly & Handicapped	0.15	0.30	0.65	0.85

Evaluation Results

Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%)			Operational Feasibility	Annual Extra Fare Collection Costs
		Avg.	Min.	Max.		
$31,774	56,940	54	45	98	Very Poor	$150,000

Once again, several tests were performed. In each test, the fare for the large first zone was held at the current 65 cent level. The second zone fares were either $1.00 or $1.15. Finally, the analysis considered outer-zone fares of $1.25, $1.30, and $1.50.

Three of the four combinations met the revenue criterion; however, some were more equitable than others. Operationally, management felt the $1.15 fare for Zone 2 would lead to fraud and less transit usage. Based on a complete evaluation of all the criteria, management felt the $0.65, $1.00, and $1.50 fare level combination for the three zones was superior to the others tested. The results are shown in Table A-12. The increased cost of operating this fare structure is estimated to be $100,000 per year.

Table A-12

OPTION C: THREE-ZONE FARE STRUCTURE WITH LARGE CENTER ZONE

New Fare Levels Tested

Fare Paying Category	Zone 1	Zone 2	Zone 3
Cash Fare	0.65	1.00	1.50
Tickets	0.65	1.00	1.50
Monthly Pass	0.50	0.90	1.35
Express	N.A.	1.25	1.75
Elderly & Handicapped	0.30	0.50	0.75

Evaluation Results

Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%)			Operational Feasibility	Annual Extra Fare Collection Costs
		Avg.	Min.	Max.		
$32,295	47,945	55	40	131	Poor	$100,000

Option D: Peak/Off-Peak Structure in the 65 Cent Off-Peak Fare

A peak/off-peak fare option was also tested to determine the effectiveness of charging by time of day. In this option, the off-peak fare was held at the 55 cent level. Three different peak fare levels were tested.

Increasing peak period fare by ten cents does not raise enough farebox revenue to meet the preestablished criterion. Peak fares at or above the 85 cent level, however, do meet the revenue criterion. If peak-period fares are raised by as much as one dollar, ridership loss exceeds the target value and $3,000 more revenue is raised than needed. The test that yields the best results for this fare option is shown in Table A-13.

All three plans have the same operational problems: enforcing the peak-period fares during the changeover from off-peak to peak hours. The additional printing and driver costs associated with this plan are estimated close to $75,000 per year.

Table A-13

OPTION D: PEAK/OFF-PEAK FARE STRUCTURE WITH $0.65 OFF-PEAK FARE

New Fare Levels Tested

Fare Paying Category	Peak	Off-Peak
Cash Fare	$0.85	$0.65
Tickets	0.85	0.65
Monthly Pass	0.70	0.50
Express	1.25	N.A.
Elderly & Handicapped	0.60	0.30

Evaluation Results

Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%)			Operational Feasibility	Annual Extra Fare Collection Costs
		Avg.	Min.	Max.		
$32,885	47,863	56	24	146	Good	$75,000

Option E: Peak/Off-Peak Fare Structure with Reduced Off-Peak Fares

One way to take advantage of the different fare elasticities for peak and off-peak riders is to charge less during the off-peak and more during the peak. The option is often considered because reducing off-peak fares generates more riders during the midday than are lost during the peak when fares are raised. The result is that both revenues and ridership can increase simultaneously.

Three different fare level combinations were tested for this option. The first test lowered off-peak fares to 30 cents, and generated more riders, but the revenue generated did not meet the minimum allowable. The second test met both criteria. In the third test, fares were raised higher than needed to meet the revenue target and ridership dropped off.

As a result of these tests, an 85 cent peak and 35 cent off-peak fare plan is recommended because all criteria are met. These results are shown in Table A-14. The operating and fare collection problems associated with the last fare option also exist here. The enforcement problem may be greater in this case, however, because the peak/off-peak price differential is much larger.

Table A-14

OPTION E: PEAK/OFF-PEAK FARE STRUCTURE WITH REDUCED OFF-PEAK FARE

New Fare Levels Tested

Fare-Paying Category	Peak	Off-Peak
Cash Fare	$0.85	$0.35
Tickets	0.85	0.35
Monthly Pass	1.75	0.27
Express	1.50	N.A.
Elderly & Handicapped	0.85	0.35

Evaluation Results

Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%)			Operational Feasibility	Annual Extra Fare Collection Costs
		Avg.	Min.	Max.		
$32,114	51,149	54	25	120	Good	$75,000

STEP 5: RECOMMEND A FARE PLAN TO TRANSIT BOARD

A best fare level plan for each fare structure option has now been determined. One of the five options must now be selected as the recommended plan.

USA Transit management agreed not to weight each plan, but rather to present the analysis results for each fare option to the transit board. The presentation will include each of the evaluation criteria and the rationale for recommending the fare plan selected as the best for the transit system.

Table A-15 presents the results of the fare analysis. The best fare plan under each fare structure option is presented, along with the existing conditions. Each option can be judged according to how well it meets each of the evaluation criteria established at the beginning of the study.

The flat fare option will only meet the revenue target with a large sacrifice in ridership. Management is convinced that such a large fare increase would not be acceptable to the transit board. Moreover, the flat fare option does not improve the equitable distribution of fares among ridership groups.

The four-zone fare structure, while clearly the best in terms of ridership and revenue generation, is unacceptable from an operational perspective at this time. The three-zone option is an acceptable improvement. The revenue, ridership, and fare collection criteria are all met.

Of the two time-differential pricing policies, the last option is superior. The revenue target is nearly met and ridership is increased due to the lower off-peak fare. The fare structure is more equitable and the operational and fare collection costs are within the acceptable range.

Options C and E, therefore, are the best two options of the five under review. The management team selected Option E (the peak/off-peak option) as the recommended plan for four reasons:

- ridership is expected to increase as revenues increase,
- the cost of fare collection is lower,
- the drivers preferred a peak/off-peak plan over a distance-based plan, and
- the marketing group felt it would be easier to sell a fare plan that includes a fare reduction for one segment of the population.

For these reasons, the staff and management of USA Transit recommended to the policy board that the peak/off-peak pricing scheme be adopted as the new fare plan for FY84.

Table A-15: SUMMARY RESULTS OF FARE ANALYSIS

	EVALUATION CRITERIA						
	Daily Revenue Production	Daily Ridership Level	Revenue/Cost Ratio(%) Avg.	Revenue/Cost Ratio(%) Min.	Revenue/Cost Ratio(%) Max.	Operational Feasibility	Annual Extra Fare Colletion Costs
Existing Fare Level	$28,145	50,000	50	18	137	Excellent	None
Target Values	$33,000	47,500	55	30	100	Good	$112,500
Acceptable Ranges							
Minimum	$31,680	46,000	--	25	None	Poor	None
Maximum	None	None	--	None	120	None	$150,000
Fare Structure Options							
OPTION A: Flat Fare Structure	$32,194	45,696	55	24	149	Excellent	0
OPTION B: Four-Zone Fare Structure	$31,774	56,940	54	45	98	Very Poor	$150,000
OPTION C: Three-Zone Fare Structure	$32,295	47,945	55	40	131	Poor	$100,000
OPTION D: Peak/Off-Peak Fare Structure With Existing Off-Peak Fares	$32,885	47,863	56	24	146	Good	$ 75,000
OPTION E: Peak/Off-Peak Fare Structure With Reduced Off-Peak Fares	$32,114	51,149	54	25	120	Good	$ 75,000